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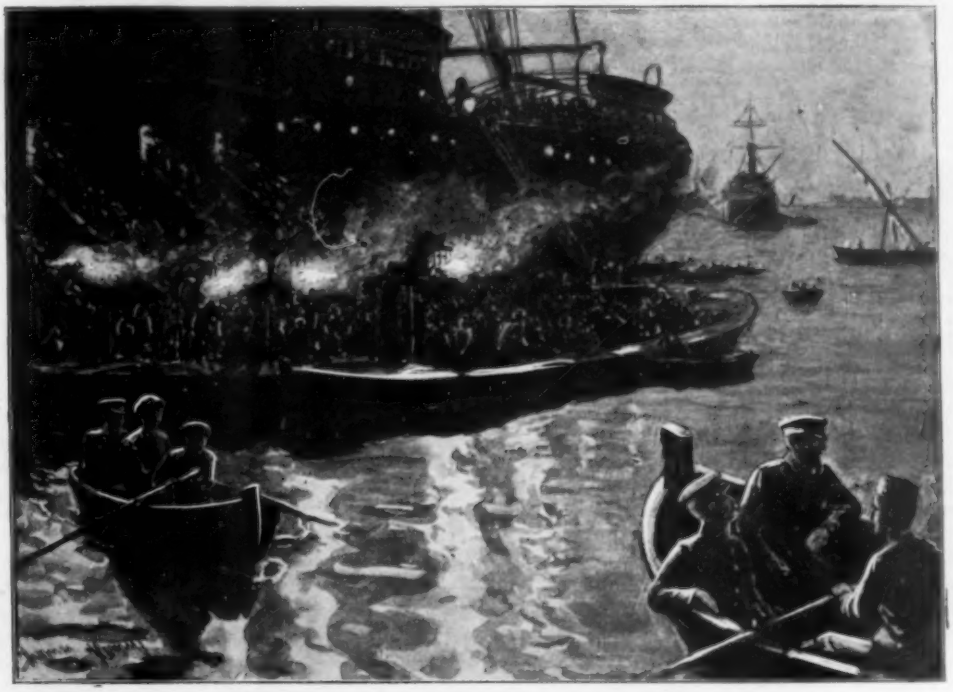
How England Plays the Game of Nations

Makes Other Countries Do Her Fighting--The Japanese-Russian Controversy and Its Real Cause

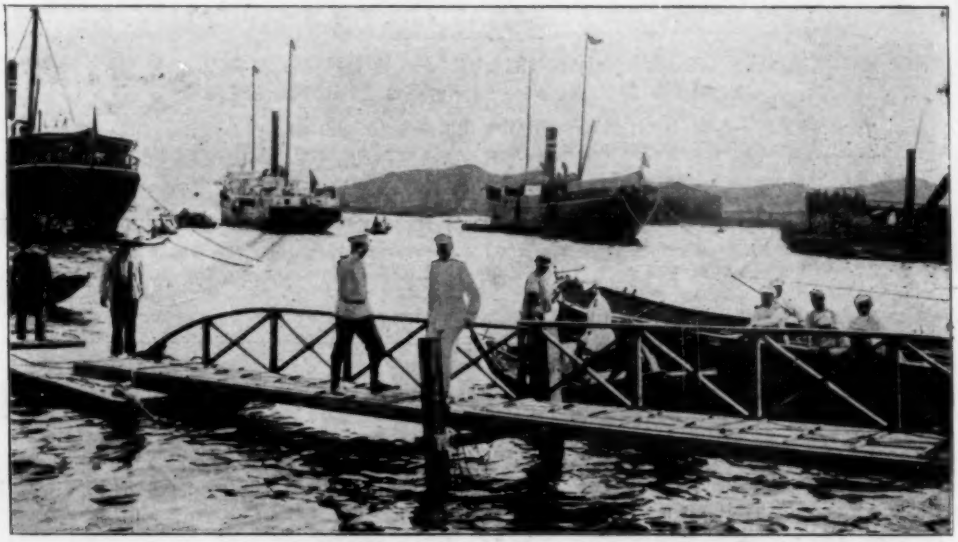
For weeks there has been the ringing and clinking of the cannon-smith and the shipbuilder's tools on board the Russian and Japanese warships. Their riggings and armor overhauled and polished, their guns all placed and tested, the vessels of the two opposing fleets have long waited in seeming readiness to begin the work of destruction and death. At Port Arthur, Vladivostock, Seoul, Mesampho, and Fusan there has been the greatest activity in placing the shops in fighting trim, providing war equipment and distribution of supplies. Chicago has shipped great supplies of war meat to the army departments of the opposing nations and Minneapolis has been busy filling orders for flour.

Late information, however, indicates a temporary postponement of hostilities, unless Japan decides to force a conflict despite Russia's concessions. The Czar is proving to the world that he was in earnest regarding his peace policy and now seems determined to prevent a conflict even though Russia should suffer the loss of territory, prestige and important strategic positions in the East. At first the newspapers scoffed at the Czar's attitude, alleging that



Coaling the Russian Fleet at Port Said

his advocacy of universal peace was all hypocrisy and designing, but late developments have destroyed all doubt to the unprejudiced that Russia's ruler is unalterably opposed to the horrors of war and that Russia in action as well as in word is willing to lead the way to an international agreement that will abolish war for all no less consequence than waging a war for her. "Rule Britania" is Britain's national air and motto, and Britain's known object is to rule the world. Therefore, it is with constant dread that Britain views the increasing population of the great territory stretching across two continents and ruled by the Czar.



In the Harbor of Port Arthur, Russia's Chief Naval Base in the Pacific

Three transports are gathered with the armoured vessels at Port Arthur. Japan thinks that by right of conquest she should have retained Port Arthur after the war of 1895. She was forced to surrender it by diplomatic action on the part of other Powers. Russia can dock and repair at Port Arthur, and a new dock is approaching Completion at Dalny.

times to come. It would be greatly to Russia's advantage to avert war until her vast territory is more thickly populated. But it is not believed that the Czar's desire for peace, nor the intercession of nations can long avert the threatened war. Diplomats agree that it is an unavoidable event in the game of nations, and that all the Czar can do at present is put off the conflict until another day.

It is not Japan, but England, that is to wage the war on Russia. Japan is only one of the chess-men that the British Empire is moving to checkmate the great accumulating power to the north and east and nearly everywhere—the Russias. It is England's old policy to let other nations fight her battles. Whenever England enters into a treaty with another nation it is pretty certain that that nation will soon be called on to perform some very important service for England—a service of probably

English diplomats, by their fine scheming, are usually able to bring about strained relations between any two nations they desire and such is always done when England desires something that a threatened or actual war is necessary to accomplish. These diplomats only strive to keep their work secret and to keep it from being known that England is back of the controversy, but when an after-study is made of the conditions England's fine hand can be seen in nearly every war and strained relation that has occurred in the world in many a year.

So England's desire now is to create antagonism towards Russia among all nations. War news furnished to the world's newspapers may be dated St. Petersberg, Vladivostock, Port Arthur or Tokio, but it always comes from London, and is the war news that England's newspaper correspondents send from the fields of hostilities.

Thus such information, while it may sometimes appear hostile to England on its face, is generally just such information as England desires to be sent and thus the world's opinion is molded as London desires. Americans might have noticed the change in

Where the Warships Are Held in Leash

The Russian fleet is divided into two parts—one at Port Arthur and one at Vladivostock. These ports are 1,200 miles apart by sea. The Japanese fleet is concentrated in or around the dockyards at Sesesho and Kure. Great mountain ranges seam Korea from end to end. If the Nipoonese admiral is a good seaman he ought to prevent the Russian fleets from uniting and if Japan can catch first one of the Russian fleets and then the other it can easily beat them both.

sentiment of this country toward Russia of recent years. This change came despite Russia's supplication for the United States to remain friendly.

The Russo-Japanese war when it comes will be of world-wide importance. It will not merely determine the fate of Corea or Manchuria or even of China, but it will change the conditions of all Europe and maybe of the world. It will determine as to whether the lion or the bear is to dominate. This is why diplomats say the war must come. Russia and the British Empire are too big for both to exist in the same world at the same time. Besides Russia refuses to become allied with England in any way or to adopt any of England's policies of trade expansion. If so, England

would soon control Russia commercially, and that is the kind of control England desires, even if Russia should not go to war.

The controversy with Russia was provoked by England and has been long approaching. The permission for the United States to dig the Panama canal, the open door in China, permission for the United States to acquire Panama in digging the Panama canal and the treaty between England and Japan were all events carefully planned in London leading up to the present disturbance.

The London Graphic says: "It has always been one of the chief maxims of British foreign policy that great maritime highways like the Straits of Korea, the Straits of Gibraltar, the Bosphorus, and the Sound, for example, must never be allowed to fall within the control of any strong Power, with the exception, bien entendu, of Great Britain herself. Of late years this maxim has been modified, chiefly by Lord Salisbury, in the direction of adding to the exception such other Great Powers as are sufficiently friendly to Great Britain as to render all hypotheses of a serious conflict with them unreasonable. Thus, after resisting for generations the attempts of the United States to obtain control of the Isthmus of Panama and of the Island of Cuba, as calculated to command one of the entrances to a possible Panama Canal, Lord Salisbury agreed to terminate the Clayton-Bulwer Treaty in which this policy was embodied, and to give a free hand to the United States in the conviction that the control of the proposed highway by America would never be detrimental to us."

Russia's policy is to acquire all adjacent territory possible. She has long had her eyes on China, even now dominates Manchuria and considers the acquisition of Korea of exceptional importance in that it would enable her to dominate one of the great maritime highways of the world. The Straits of Korea divide—or one might say, unite—the Sea of Japan and the Yellow sea. A strong power established at Masampho could easily render intercourse between the two seas a difficult matter. Russia at Mesampho would be a perpetual menace to England, and would seriously disturb the balance of power, making Russia impregnable. Russia with her vast territory is increasing her population of 120,000,000 at the rate of 1,500,000 annually. Marching steadily, almost resistlessly toward the Pacific; advancing with railroad and army and traders and acquiring possession of the most strategic points on the Eastern map, it would soon be that nothing could stem

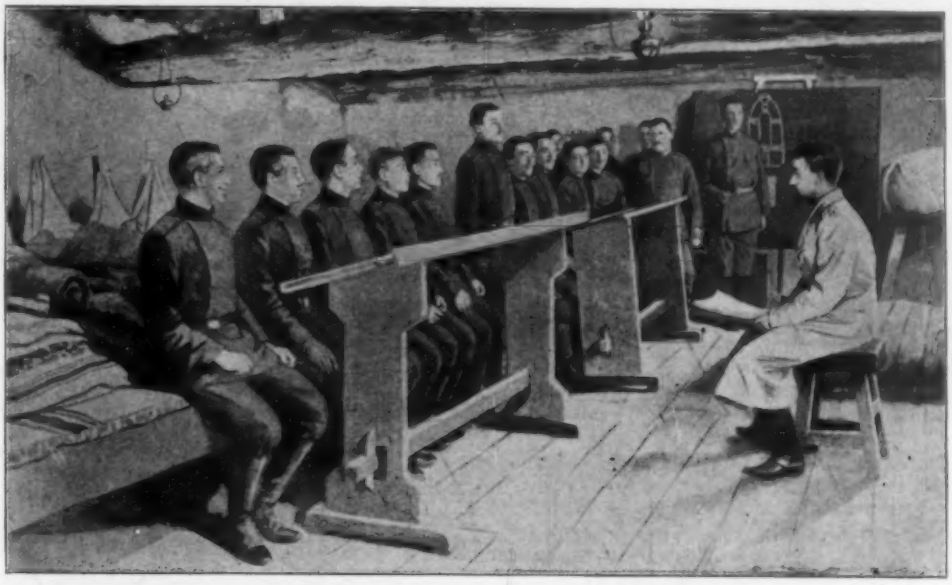
Fusan, one of the eight ports of Korea, is situated on the south-eastern coast. Until 1900 none of the ports were connected with the capital, Seoul; but since then railway connections have been granted, and much has been done towards opening up the country. The cost of the line between Fusan and Seoul was subsidised by the Japanese Government. This railway when completed will enable Japan to transport an army into the Korean capital within the space of thirty or forty hours.

the tide of Russian aggression. It is this progress of the great northern power that is worrying England and that England is determined to check before it is too late.

It is undoubtedly England's desire to force the war now, for Russia has not been awake to the plot against her. Her navy is weak and it is believed Japan could win an easy victory in a war at sea and most of the fighting would undoubtedly be at sea. While Russia, ignorant of the designs against her has been building railroads and improving territory, Japan, aided by England, has been building warships and there will be great disappointment in both England and Japan if Russia makes concessions that will avert war now when everything would indicate a Russian defeat.

Japan's fighting force at sea well outbalances that of Russia. Japan has long been busy building new warships, overhauling her old ones and equipping all of them, with English aid, with the very latest, most effective armament. The ships that would be brought together in case of conflict on the Russian side, consist of seven battleships and four armored cruisers. The battleships are of from 10,960 to 13,100 tons. Three of the armored cruisers are of from 10,960 to 12,364 tons and one of 7,800 tons.

The Japanese side would consist of seven battleships, six of from 12,517 to 15,443 tons and one of 7,335 tons; six armored cruisers of from 9,456 to 9,906 tons. The sum of the forces are 119,577 tons Russian opposed to 152,493 Japanese.



An Underground Russian Military School in Manchuria

The Russian soldier is an excellent fighting man, but, as a rule, is almost without any education, and not well trained. In Manchuria, however, efforts are being made to improve his military training and at numerous points on the railway underground military schools have been established.

In addition Russia has twelve torpedo boat destroyers and 16 torpedo boats to oppose Japan's 19 torpedo boat destroyers, 13 first class torpedo boats of from 120 to 150 tons; 36 second class torpedo boats, of from 80 to 90 tons, and 27 third class, 40 to 65 tons.

Four of the Japanese battleships exceed the largest Russian battleship, the Czarovitch, by from 2,388 to 2,743 tons.

The armored cruisers would play an important part in a war where there is such a scarcity of heavy battleships. The Japanese armored cruisers are among the most formidable in the world and are equal in fighting value to some of the heavy battleships because of the 6-inch protection to the guns of their heavy 6-inch battery.

Russia's ships can bring into action but 42 armor-piercing guns against 68 of the Japanese ships. Japan also has 214 6-inch guns against Russia's 138. Russia has in the East seven protected cruisers of from 3,200 to 6,300 tons mounted with forty-eight

6-inch guns. Japan has sixteen protected cruisers of from 2,700 to 4,973 tons mounting two 12½-inch, four 10.2-inch, six 8-inch and thirty-eight 6-inch guns. On both sides the ships are well supplied with torpedoes.

Japan's armored ships that would be brought into action in the event of war consist of the Mikasa, 15,200 tons displacement; Asaki, 15,000 tons; Hatsuse, 15,000; Shikishima, 14,850; Fuji, 12,320; Yashima, 12,320; Yakumo, 9,750; Tokiwa, 9,750; Asama, 9,750; Chen Yuen, 7,490, and the Azuma, 9,436.

Russia's armored ships that would engage in the war are: Czarovitch, 13,110 tons displacement; Retvizan, 12,700; Pobieda, 12,674; Peresviet, 12,674; Gromovol, 12,336; Rossia, 12,200; Sevastopol, 10,960; Poltava, 10,960; Petropavlovsk, 10,950; Rurik, 10,940, and the Bayan, 7,800.

In both lists the ships include battleships and armored cruisers.

A new and mysterious craft that Russia has just added to her fleet of destroyers is the "Perr Kochka," illustrated on the front page. It is a submarine, the mechanism of which the czar's government is endeavoring to keep a profound secret. It is the queerest looking craft ever put into the ocean, and beneath the top shown in the illustration is a lot of intricate mechanism that none but Russian eyes have ever seen. Russian experts have long been working on this craft, and there is reason to believe it the most perfect and deadly submarine ever built When launched at Port Arthur it dived under the water and out again, rising and sinking at will and appearing at altogether unexpected places, much to the astonishment of the spectators and to the great delight of its builders.

The submarine has extraordinary facilities for fastening destructive torpedoes to the hull of war vessels and making its escape before the torpedoes explode. It is also remarkable for its carrying capacity. It carries a large crew besides a great weight of steel construction and underwater paraphernalia. Several of these boats are under construction by the Russian government, and they are relied on as much as the men-of-war to repel the Japanese fleet that attempts an invasion on Port Arthur or Vladivostock.

Such great secrecy is maintained in the mechanism of the "Perr Kochka" and her sister submarines that only trusted government employes were intrusted to the work of building them, and every workman was given to understand that any hint given out as to the method of their construction would be cause for capital punishment.

WEATHER FORECASTING TO BE MADE PERFECT.

Radium and Roentgen Rays May Aid Us in Knowing Today Exactly What the Weather Will Be Tomorrow

Absolute accuracy in weather predictions is promised through the medium of radium and the X-ray. When the system is perfected, according to scientists, we may know today exactly whether it will be raining, snowing, clear, warm or cold at any time during the next two or three days. This information comes in a book that has just been issued by Prof. Thompson, of Cambridge, entitled "The Conduction of Electricity Through Gases." The book records the labors of scientists who for eight years have been studying the power of an X-ray to turn into conductors of electricity for the time being air or other gases through which it was made to pass. It is this power and the conduct of the conductors when the radium is acted on by the electricity that makes possible the accurate predictions.

BALLOON FOR SAILING TWENTY MILES ABOVE EARTH.

Occupants to Ride in Hermetically Sealed Steel Shell—Londoner's Invention

Traveling in a balloon twenty miles above the earth may be possible through a craft that has just been designed by Eustace Short, of London, according to the inventor's claims. Six and a half miles above the earth is the highest point ever reached by a human being heretofore, and the greatest height ever attained by a balloon carrying self-registering instruments is 13½ miles.

Short claims that the height of twenty miles above earth in his balloon can be attained without the accompaniment of gasping for breath, bleeding at the nose and other discomforts. The balloon car is in reality a steel ball seven feet in diametr and is filled with compressed air. The occupants will be hermetically sealed inside this spherical shell. The ballast will be carried in a cone-shaped vessel hung between the ball and the balloon. The steel of the shell will be 1-16 inch thick. Short intends the balloon for scientific investigations at great heights, and asserts it will be perfectly safe.

Popular Mechanics want ads are the best bargains ever offered for the money. Try one.

Chicagoans Gave their Lives for Our Protection

Iroquois Dead Among the Many Sacrifices Required to Rid America of Imposture

Six hundred persons died that Chicago might have the safest theaters and amusement resorts in America. Little children, school girls and mothers principally composed this human sacrifice. Their deaths will have beneficial results throughout the country, but many more lives will be the cost of substantial building construction in America, which has not yet learned that counterfeits are costly.

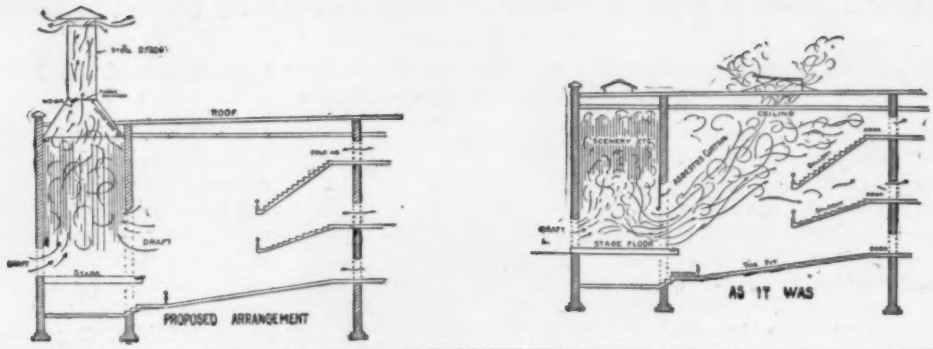
The Iroquois

America's buildings of all classes are the least substantial of those of any civilized country. Each class of buildings is improved after lessons similar to those of the Iroquois fire. The great Chicago fire of 1871 made Chicago's business houses more substantial. The thousands of persons that are being slaughtered by the railroads are slowly causing the railroads to give us safer means of travel. Newness in America's institutions is nearly synonymous with dangerousness. Aging brings death and death teaches the lesson. It will take time and hundreds of lives to give substance to our country's structures. The collapsing of a skyscraper—they are new—will result in stronger structures than the frail shelled frames that now dot our cities.

Money greed, the ravenous desire to realize great returns from small investments, and disregard for the adage "honesty is the best policy," are the causes of these conditions that menace the lives of Americans and cause our country to be famed and marvelled at for its unparalleled disregard of human life. There were many lessons taught by the Iroquois fire, yet they were not sufficient, and many of us now living must give our lives to fully imbue corporations and municipalities with the great truth.

The Iroquois theatre, which burned with such direful results on the afternoon of Dec. 30, was gorgeously new, presenting a new fairy play, displaying resplendent new scenery and spectacles. It was a gilded void. Its management sought to deceive the public into believing it wonderfully strong, safe and expensive. They smiled contentedly at the success of their deception and chinkled their profits. The officials of Chicago, whose duty it is to enforce the building laws, sought to deceive the public into believing that they had fully inspected the theater and found it equal to all the requirements of the law, and they smiled at their successful deception and enjoyed the complimentary tickets awarded them for their ability to deceive. The man who made the "asbestos" curtain sought to deceive the public and others into believing the screen that hung in the proscenium arch was absolutely fireproof and would protect them from danger should a fire occur on the stage. His ruse succeeded, temporarily, and he laughed to himself as he pocketed the money for an imitation and thought how easily the people were beguiled. And all the way down, from the design of the building to the operation of the doors is a story of practicing to deceive, a temporary success and a final horrible failure.

The management, so elated over their successful deception, are now ruined, crushed, accursed and a hundred times rather would have spent thrice the amount in making the theatre what it appeared to be. It will cost them in money, and money was their first consideration, a hundred times the cost of the Iroquois theatre before the debt to the victims and to justice is settled. The officials who were so glad that they could elude the people so easily and get free theatre tickets whenever they desired, are now on trial for neglect of duty, and even though politics has robbed their conscience of punishing power, they must have spent in money, and money was their first consideration, many times the cost of



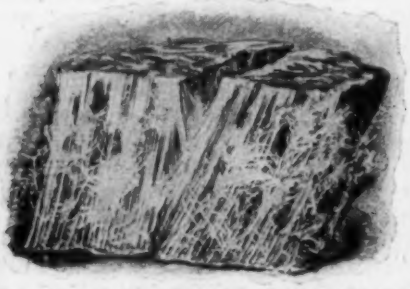
The above drawings illustrate an arrangement of theatres that would have prevented the flames from sweeping upward through the auditorium and causing such an enormous death rate among the occupants of the balcony and galleries as was the case at the Iroquois. The principal feature is a smokestack over the stage built of steel or other incombustible material of sufficient area and height to carry off the products of combustion. In a building where a sufficient area cannot be spared for a large stack the height can be increased to compensate. To guard against the weather a metal hood should be placed over the top, as shown in the design, which would be always open. To prevent escape of air when there is no fire a damper made of thin paper, secured between woven wire screens, should be placed across the lower end of the stack. It would be weighted to open automatically, but held shut by a small cotton cord passed across the top of the stage and then down to a cleat within reaching distance from the floor. In case of fire on the stage the cord could be released by a stage hand; or, if overlooked, the cord would soon burn and release the damper, which would then swing open; or, in any event, the paper would quickly burn out of the damper and the stack would instantly exert an enormous suction. As soon as the stack was thus thrown into operation there would be no more heat or smoke at the proscenium arch than in front of a furnace when the door is thrown open.

It is impossible to abolish inflamable material or lights in the stage setting for a spectacular production. Then the fire is ready to light and it is time to provide a chimney for it.

many theatre tickets, before their cases are settled. The man who made the "asbestos" curtain three parts of cotton, and chuckled amusedly at his successful imitation, now faces dismay, for his reputation has spread broadcast and he will probably never sell another, even of his real asbestos curtains. Rather now would he have given the Iroquois theatre ten pure asbestos curtains.

It was this spurious asbestos curtain, many claim, that caused the wholesale loss of life in the Iroquois.

There is a prevailing opinion among the public, as a result, that asbestos is not fire-



proof. Such is, however, extremely erroneous, for real asbestos cloth cannot be burned, no matter how great the heat to which it is subjected. It is cotton, sometimes mixed with asbestos, that burns. Asbestos cloth is woven mineral. The mineral, which resembles a fibrous rock, is mined in Canada, parts of the South and West and in many parts of Europe. It was known to the ancients. The finest fibrous variety is called amianthus, from a Greek word meaning indestructible. Cloth made from it was used to enwrap dead bodies placed on the funeral pile, so as to preserve the ashes of the body unmixed. The finest amianthus is found in the Tarentaise in Savoy, Scotland and several of the Shetland islands. The rock-like mineral when mined has fibrous threads clinging to it as shown in the illustration. When subjected to a rolling, mashing process it splits entirely into fibers, which are woven into cloth the same as cotton and wool are woven. Asbestos is found in layers between strata of rock. Its value depends largely upon the thickness of the layers, which are from one to three inches, the thickest producing the longest fibers, which, of course, make the strongest cloth.

The asbestos curtain has some advantages over the steel curtain, which the theatre-going public has been so loudly clamoring for since the Iroquois fire. Resembling canvas in its outward appearance it is light, easily rolled and can be handled much more

dextrously than the steel curtains. It will not burn and can be decorated as handily as any other cloth curtain.

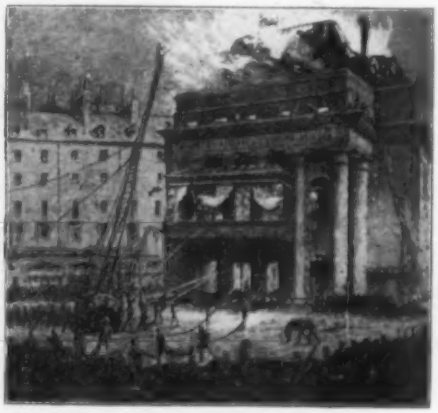
The steel curtain, however, is undoubtedly the safest in the world, but it is cumbersome to handle. There are but four steel curtains in the United States, two of which are at the Auditorium theatre, Chicago, America's largest and most substantially constructed playhouse. The two curtains are of different sizes, to meet the requirements of the stage, which can be either enlarged or made smaller, as desired. The larger of these curtains weighs 21,000 pounds and the smaller 13,000 pounds, a combined weight of 34,000 pounds. The larger is 75 feet two inches wide and 44 feet 8 inches high. The smaller, or inner curtain is 47 feet wide and 38 feet high. They are counterweighted and operated by hydraulics, being raised straight up, like a window sash, from the floor to its resting place above the proscenium arch.

The making of a steel curtain is a herculean task, being equal to the manufacture of a huge boiler or oil tank. First the parts of the great steel frame, composed of a larger outer frame with several cross sections, are bolted or welded together. Then the steel sheets are bolted to the frame in sections, forming one great steel plate or partition that is raised and lowered in the proscenium arch. The cross sections on which the plates are bolted are arranged horizontally and diagonally, making the curtain as firm as a wall. In the theatre the curtain is hung on steel cables and steel sheaves. The manufacture of steel curtains promises to become an important industry, since the Iroquois fire, as the public knows they cannot be adulterated, as can the asbestos curtain, and hence has more faith in them. Because of the failure of the false asbestos curtain at the Iroquois, there is a

Courtesy Chicago Tribune.

The Mad Rush of Death at the Iroquis

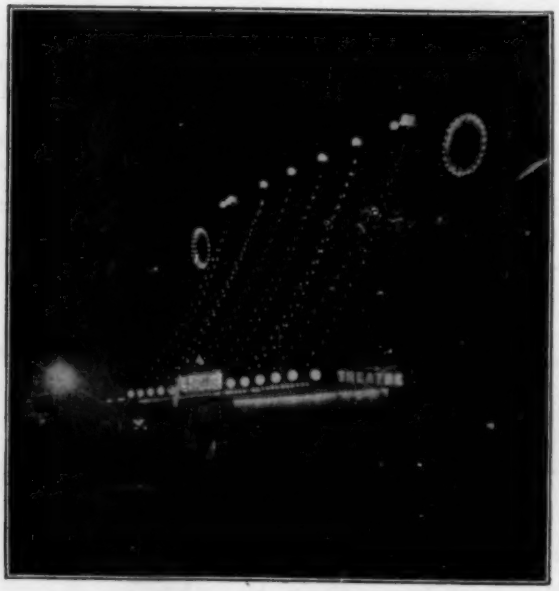
Burning of the New Theatre, Exeter, Sept. 5, 1887—Number of Deaths 130.



The Fire at the Opera Comique, Paris, May 25, 1887—Number of Deaths Estimated, 100

Burning of the Ring Theatre Vienna, Dec. 8, 1881.—Number of Deaths, 700.

popular prejudice against all asbestos curtains. Thus has the manufacturer of the Iroquois curtain not only damaged his own business, probably, but he has impaired that of every asbestos cloth manufacturer in the world.



The Iroquois at Night—Courtesy The Electric City.

THE TRUST THAT KILLS LITTLE BABIES.

Commercialism's Lowest Degradation Is Reached in the Antitoxin Combine.—How the Serum is Made

When it was discovered that antitoxin was nearly a sure cure for diphtheria there was great rejoicing among the little children and the mothers of America and of the world, for in this serum they had found a weapon to conquer their deadliest foe. Then came the antitoxin combine, the "baby-ki'ling trust," the meanest of them all, and raised the price of antitoxin so high that the children of the poor are denied its benefits. The result is that thousands of lives are imperiled. Antitoxin is not a patent medicine. Its discoverers gave to the world the process of its manufacture, and then came the unscrupulous greed of commercialism that would deny to little children the inheritance of their benefactor, unless they pay a fabulous sum to the trust which now has acquired a monopoly on the life-saving serum by virtue of money's power to buy. A good man gave to little children a process that would add to their chances of living. A mean man organized a trust, seeking to control this process and to charge fabulous prices to the little children for these chances of living. Fifty dollars is now the cost of giving a child the treatment with antitoxin. The manufacture of the antitoxin costs less than $8.

There are plans now, however, for cities and states to build their own antitoxin manufactories and to let the parents of little children have the serum at cost. This would save them from the power of the very mean trust and prevent hundreds of deaths. Dr. W. K. Jaques, of Chicago, and other of America's leading physicians, are advocating this plan with prospects of success.

Antitoxin is obtained from injecting diphtheria germs into animals, preferably horses, for reaction. It takes several months to prepare a dose of antitoxin. In the plant for its manufacture, in the equipment and in the scientific training necessary for the production of the serum, a large amount of money must be invested.

The horse might be called the living factory for the diphtheria specific. For the

reason that the horse is more susceptible than other animals to the diphtheria culture with which he is occulated, as well as the fact that he is large enough to produce the maximum amount of serum, he has been chosen as the subject for producing the antitoxin. The horse must not be too susceptible to the injections of the diphtheria culture, and aside from the merit of being dark, the horse should be strong enough, large enough and free from rheumatism, tuberculosis and glanders. The diphtheria to be injected into the animal is obtained from a malignant form of diphtheria in the human patient. From this the culture is made in alkaline boullion, afterward injected in the shoulder of the animal. Not only must this horse be selected with the greatest care, but after the injection he must have the treatment of a patient. In the beginning the injection may be not more than one-fourth of a cubic centimeter of the culture; in the end it may reach to 1,000 cubic centimeters.

Between this first treatment and the time of tapping the jugular vein of the horse for obtaining the serum, there are febrile disturbances, loss of appetite and, perhaps, loss of flesh. Everything possible is done to keep the animal's weight to the normal and when the creature fails longer to react after the injection of the heaviest measures of the culture, he is ripe for the tapping process. The time the horse has been under process of treatment and the number and amounts of cultures, with their malignancy, determine the "units" of serum that result from the coagulation of this blood.

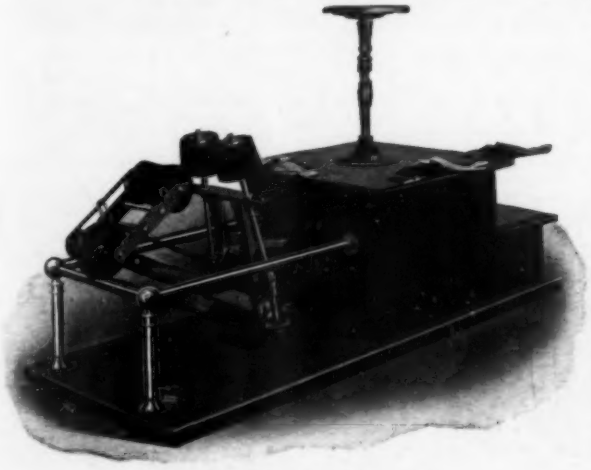
To coagulate the blood drawn from the jugular vein it is put into a jar and placed on ice. The clear portion of the blood rising to the top is the serum. Its efficiency when separated is tested by injecting a small portion under the skin of a guinea pig. The animal should die from the injections within three or four days.

The horse may be kept a subject for tapping for months, the latter cropping of antitoxin taken from his veins proving better than the first. But the strongest animals subjected to the treatment seldom live longer than two years, in which period they may have been bled a dozen times.

For the typical case of diphtheria in the human patient, the first dose of antitoxin is about 2,000 units. As to the administering of the serum a second dose should be given at the end of twelve hours if the case be one or two days old; if the case is three or four days old, the dose should be repeated in six hours, and where the case is older it should be repeated at the end of four hours. Five is the average number of doses. Seven or eight doses may be given, however, if the child's parents can afford it.

Electricity Extrudes the Bootblack

Automatic Shoe Shining Machine Arrives and Does the Work Quicker and Better than Human Hands



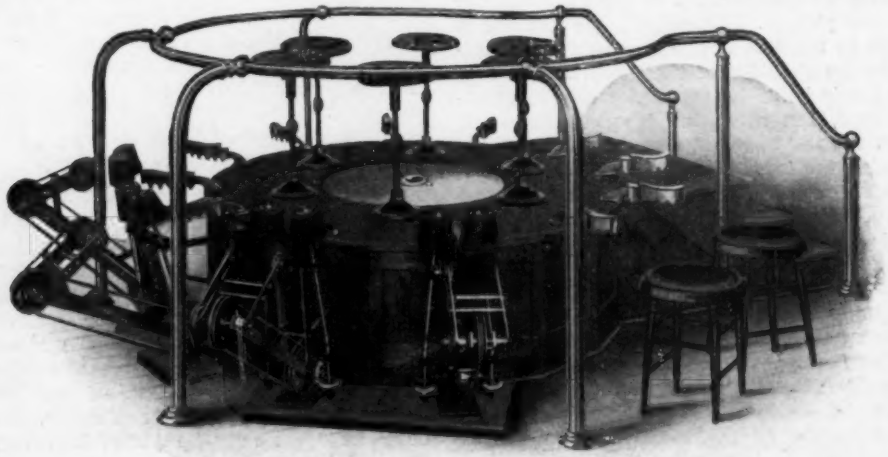
Automatic Shoe Shining Machine

Goodbye to the bootblack! He has been with us long and served us so well that we have learned to regard him as one of the country's necessary and permanent institutions. But now he must find another occupation. For the same agent that speeds trolley cars along our streets, that wings wireless words across the seas has put the bootblack out of business. The electric bootblack has come. It will shine a dozen pairs of shoes while the human bootblack is shining one.

The automatic, electric shoe-shining machine is the invention of John Zimmerman of Chicago. There is an elevated platform

on which are arranged one or several stools and around which is a brass railing. Around the edge of the platform are attached the mechanical devices with revolving pulleys and little belts. The man places his foot on the footrest in front of one of these little machines when the apparatus begins to get busy. He does not move his foot until the shoe is shined. The shining is done in stages by stationary automatic machinery. The platform revolves from station to station where automatic machines perform the different operations. One of the revolving brushes rubs polish over his shoe on the same principle that an ink roller inks a printing press. Then the other brushes are rolled over his shoe while they are rapidly turning until the shoe is polished as bright as a mirror. The boy in attendance has little more to do than collect the money. The stands are made to contain one seat and shining machine or a half dozen of them, or more if desired. The machinery is operated by an electric motor underneath the platform. At present the machines are made in two sizes—the six-seated and the single-seated. The six-seated will shine six pairs of shoes in two minutes, or 180 pairs in one hour, or 1,800 pairs in a day of ten hours. The small machine will shine 600 pairs of shoes per day. At 5 cents per shine it is estimated that the large machine will earn a net profit of $27,000 per year while the single machine will net $9,300.

The electric shoe-shining machine is handsome in design, and simple of construction.



Six Seated Automatic Shoe Shining Machine

There is no complicated mechanism, and all the parts operate smoothly, rapidly and effectively. It is of convenient size and thereby especially adapted for shoe-shining parlors of all descriptions, barber shops, shoe stores, hotels, steam and ferry boats, suburban trains, street corners and in fact any place where shoe shining stands can be found. In a few years the time-honored bootblack will have passed into oblivion.

A RENEWABLE RAIL.

The rails on both steam and street railways have to be removed and renewed when the head or top of the rail wears out. The rest of the rail is far from worn. To renew the portion which receives the wear, an English syndicate are making what is known as a renewable rail. The rail shown in the cut is a grooved girder rail, such as is used on street railways abroad. The upper part fits over the web to which it is bolted, and which serves as a joint supporter. The small bar is for "bonding" for electric roads; this bond, however, is a very poor construction.

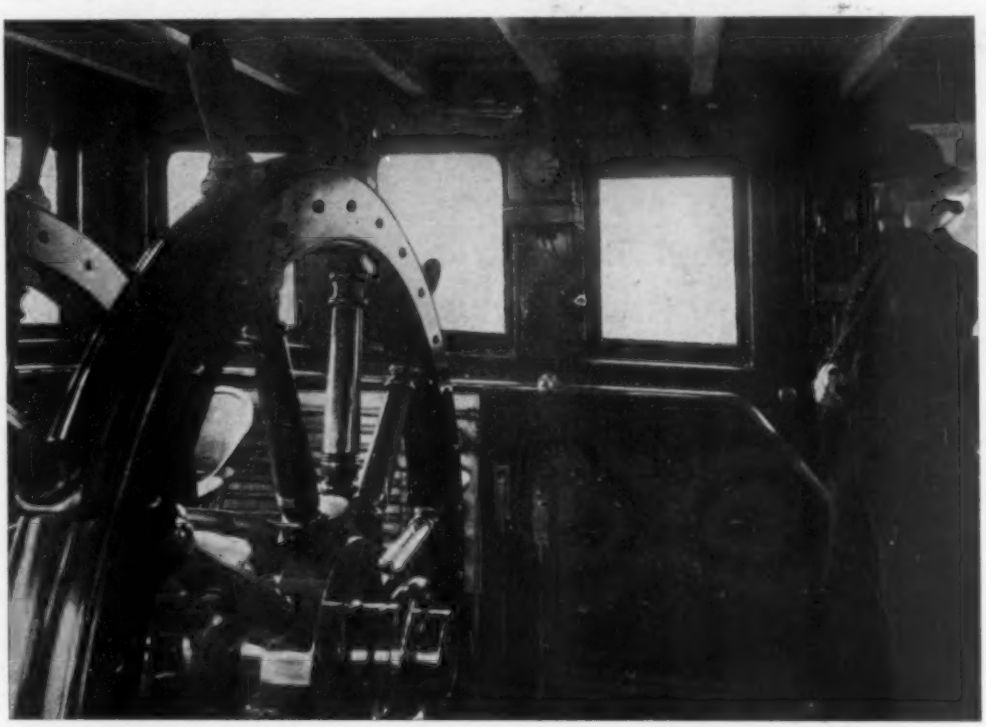
FIVE-YEAR SUBSCRIPTION.

In response to numerous requests, the publishers of Popular Mechanics hereby announce a special subscription offer of five years for $3. The address may be changed as often as desired.

Electric Ears for Ships

They Can Hear the Coming of the Submarine--Wonderful New Vessel Protection

Ships will soon have ears—ears that will hear the approach of a torpedo boat that the captain cannot see, or that will hear the sound of the fog-bell or siren on the darkest stormiest night, or that will hear the waves beating against a dangerous rock or shore the ship may be nearing. They will be electrical ears and more sensitive than human ears, because the sounds they hear will travel under water, which transmits sound far more rapidly than air. It is this superiority of the water as a sound transmitter that has brought about the new invention that may put the submarine out of business and may prove one of the greatest marine protections ever conceived.



Listening to Signals Transmitted Under the Sea.

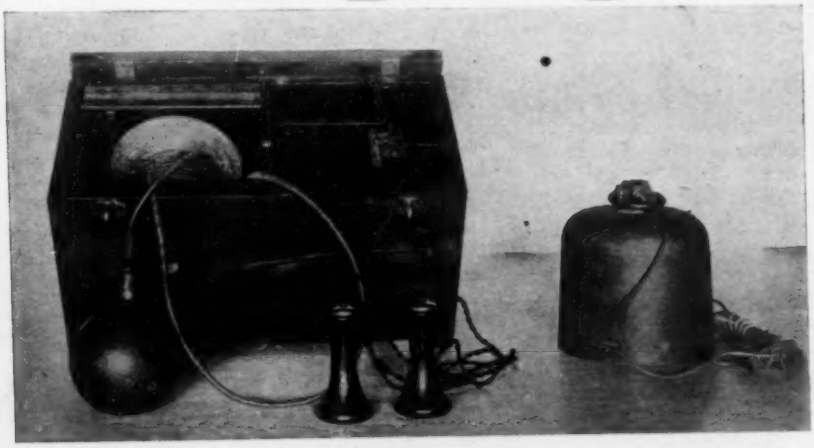
The invention is called a "sub-aqueous telephone." Its principal elements are delicate transmitters or microphones, attached to the hull of the vessel below the water line. These sentitive instruments intercept the sound waves as they traverse through the water and transmit them by regular telephone wires to the captain, who with receivers at his ears is listening in the wheel house. To aid the sub-aqueous telephone it has been proposed to equip lightships, lighthouses, bell buoys, etc., with bells that will ring in the water and thus cause the sound waves to travel at greater distance and with greater accuracy.

This system, it is believed, will enable warships to carry on telephonic signal communications with each other while at sea, no matter how dark and stormy the conditions may be above water. In averting collisions at sea it is expected to perform one of its most valued services.

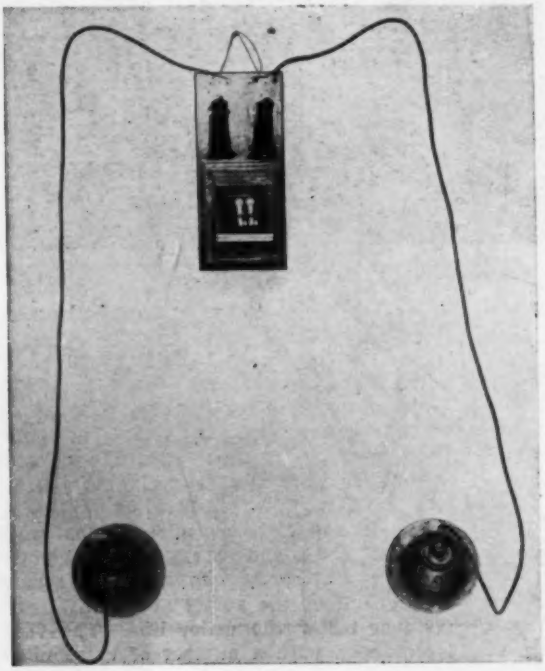
The transmitters or microphones which intercept the sound waves, are each placed inside a waterproof cup which is secured to the hull of the vessel at a considerable distance below the water line. The vessel is equipped with a number of these microphones, one of which, for instance, will be located on each side of the bow, one on

each side amidship, and one on each side at the stern.

The American Telephone Journal says: It is well known that sound waves can be transmitted through the water with as great facility as through the air, and with a considerably greater speed on account of the superior density of the transmission fluid. So if any sound waves pass through the water they will impinge upon the transmitter and can be heard in any receiver which is connected thereto. The principle of the invention realy lies in the multiplicity of transmitters which are located along the hull of the vessel and the arranging of these transmitters so that they may be successively cut into circuit with the receivers. The circuit is so arranged that two transmitters are associated with a pair of receivers which may by means of a switch (see illustration) be instantly changed from one transmitter to the other. If the vessel is approaching a coast where a lighthouse is equipped with a fog bell or a siren the sound waves produced by these will again be reproduced by similar waves in the water. These sub-aqueous sound waves will act upon and affect the diaghragms of the transmitters or microphones which will produce a current of carying intensity, which will in turn cause the receiver in the circuit to make a sound. The pilot switches his receiver successively from one transmitter to the other from bow to stern, along both sides of the vessel, and it is easy to understand that the sound produced in the receiver will be greater when it is connected to the transmitter that is nearest to the direction in which the sound is coming, and it is easy for the pilot to tell whether he is approaching a sound or receding from it, or whether it



Ball Receiver for Detecting Submarine Sounds and Associated Apparatus Arranged for a Schooner. On the Right is a Submarine Bell.



Two Receiver Cases with Connections to the Receiver Box.

is on the port or stern side of the vessel. The vibrations can be initiated by a bell that is hung over from the side of the lightship or suspended in the water, at the end of a cable, from a lighthouse, or from a bell buoy operated by the waves. The bells can be struck with a hammer exactly like a bell in the air, only with considerably more force. These vibrations are taken up by the receiver on board the vessel and transmitted electrically exactly the same as through the telephone. The ear pieces are identical with those used in the telephone. The invention does not require the captain of the vessel to use delicate telephone apparatus and tables of logarithms, but simply to use two telephone ear pieces with which to listen to the bell. In other words, the faculties that are cultivated in him are the very ones that he most uses.

A type of the sub-aqueous telephone which has been invented for fishing boats or small vessels of any kind consists of a receiving box with a ball receiver which is lowered into the water. It is obvious that some sounds would be too delicate to penetrate the skin of a vessel, and might not be heard by a receiver located on the inside. Hence it is that the receiver is lowered directly into the water and picks up sounds of comparatively small intensity. In case of emergency where a vessel is not supplied with receivers located on its hull, by lowering one of these ball receivers, first on one side of the vessel and then on the other, and noting the difference in intensity of the sound, it is perfectly practical to locate the source of the signal, whether it be the signal of a fisherman in a dory, or a bell buoy, or any other signal.

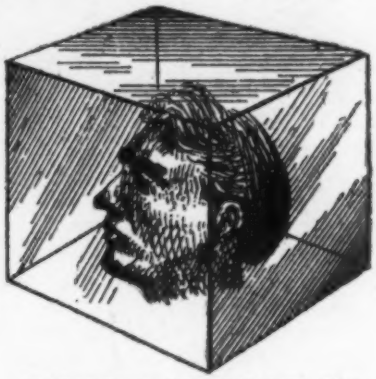
WRITING PAD FOR DESK TELEPHONE.

With the increasing use of the desk telephone has come a demand for some means of holding a tab of writing paper which will be always at hand and which will also be in convenient position for use without the necessity of being held with one hand while the other wields the pencil. The illustration shows such a device, on which a patent was granted last month.

WEIRD METHOD OF EMBALMING.

Corpses to be Encased in a Solid Block of Glass.

The strangest, weirdest method of embalming ever thought of has just been patented by a Russian residing in New York state. The corpse is to be encased in the center of a solid block of pure glass, through which the features and outlines of the body will be perfectly visible. As no air can ever possibly enter, the remains are expected to be preserved for centuries. The inventor hopes that some day a vast mausoleum of noted and gifted men will be erected, in which it will be deemed the highest honor to be thus preserved for future generations. The block of glass containing the body is to be eight feet long and of suitable width and depth. These blocks could be placed in a horizontal or vertical position, and in the course of a hundred years scores of the nation's famous writers, statesmen and soldiers would thus be assembled in a grand gallery of the dead. At least that is his plan.



Head of Corpse Incased in Solid Glass

The mechanical process which is to make all this possible, and on which the United States government has granted a patent, is quite simple. The remains are first surround with a coating of sodium silicate, or water glass, which is allowed to dry. When the water has been sufficiently evaporated, the subject is placed in a mold which is to determine the size of the glass block, and molten glass poured until the mold or flask is filled.

There have not as yet been any candidates for being thus preserved for future reference—but then, the patent was only issued last month.

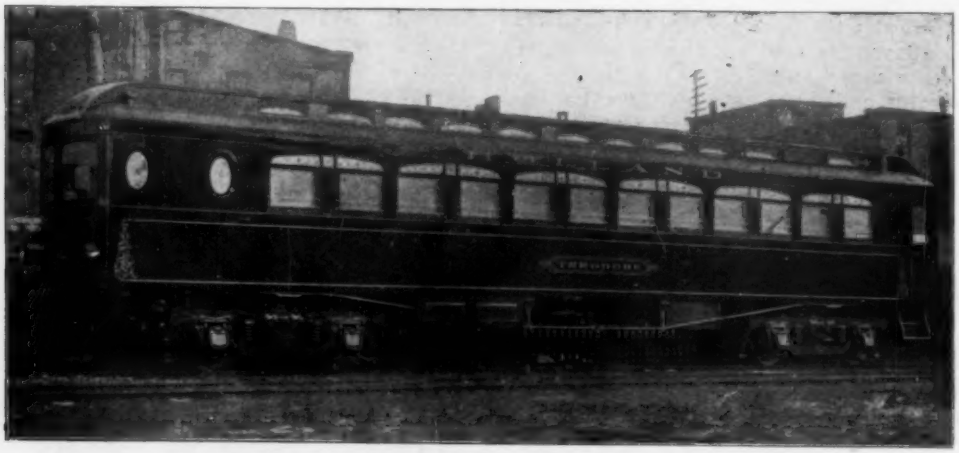
The Trolley Sleeper Has Come

Service Beginning Between Indianapolis and Columbus is to Spread All Over the Country

Trolley sleepers have been put in service between Indianapolis, Ind., and Columbus, O. The "Indiana" enjoys the distinction of being the first of these sleepers ever built. The "Francis" was the second to reach completion and both of these are now in operation. Orders have been placed for 24 combination sleeping and dining cars. Within eight months it is expected that the service will be extended to Wheeling, W. Va., and Pittsburg, a distance of 400 miles to the east; to Cleveland and Buffalo, almost as great a distance northeast, and to Toledo and Detroit and around the Lake Erie front to Cleveland. Within 18 months, it is promised, the sleepers will be running between Chicago and Cincinnati via Indianapolis. It is the ultimate plans of the Boston capitalists, the Appleyard syndicate, to operate the sleepers and diners between August, Me., and Chicago and St. Louis. This is expected to result within three years.

Pullman company owns and operates its cars over the steam lines.

The cars will be geared to run 60 miles an hour. The smallest will have 20 berths made into compartments. The comforts of passengers is provided for even to the extent of electric hair curlers in each compartment for the women, and electric cigar



The First Trolley Sleeper

In the very shops in which the first Pullman car was built, the first "trolley sleeper" came into existence. An agreement is said to have been entered into with the Pullman Company, whereby that company will not make trolley sleepers and the trolley sleeping car company will not let its space saving inventions go into the steam road service.

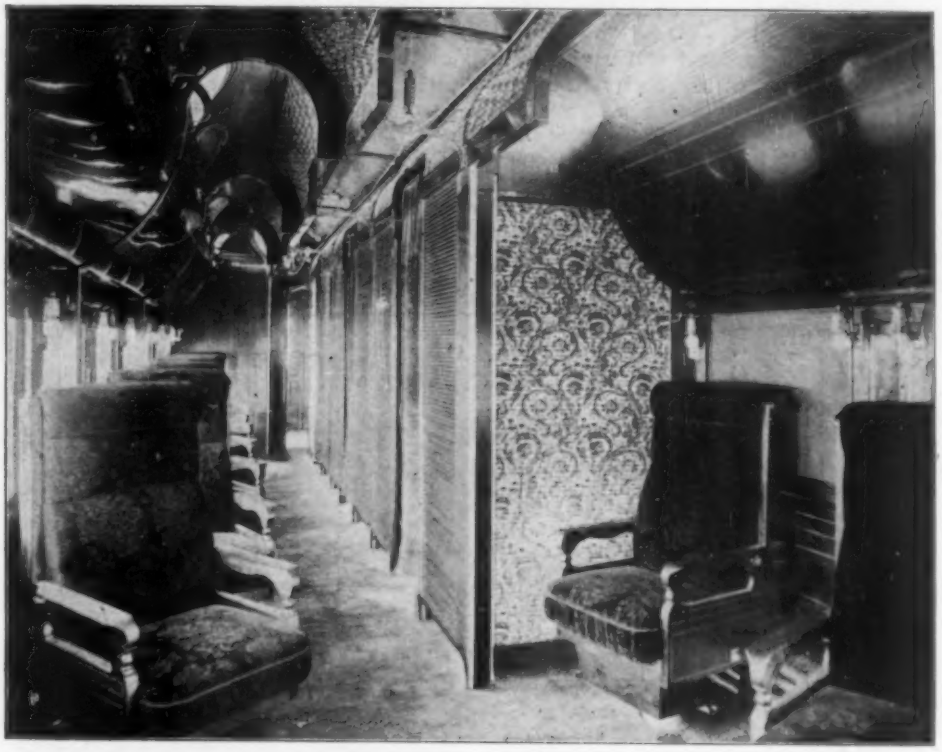
The trolley sleepers are being built by the Holland Palace Car Co., composed of Indiana men. The cars will be owned and operated by the company, identically the same as the

Interior View Convertible Sleeper and Trolley Car.—Day Arrangement

whereby the lights in that compartment can be "raised" or "lowered" or "put out." Each compartment is ventilated separately lighters for the men. Each compartment will be equipped with electric appliances and windows are raised and lowered by pressing buttons. When the night's ride is over all compartments are rolled into the walls and into the floors and the beds are rolled up into parlor car chairs and the car is nothing more nor less than a parlor car itself. There are large and well equipped toilet rooms for women and men. Passengens can stand while dressing and lock a door on their possessions. All berths are single, four feet wide. The combination sleepers and diners have a 10-foot compartment between the berths and the rear retiring rooms. Temporary tables are placed between chairs and the service is quite as complete and elegant as given in the steam road cars.

The compartments for the night runs are made with mahogany rolls similar to the roll tops used in desks. They come out of brass slots in the floor and dovetail into and fasten into each other when up, making a perfectly rigid and elegant wall with a doorway. The upper berth is let down from the wall on the same principle that is employed in the Pullman car.

The elegantly upholstered chair of the day parlor car is a revelation. Two of these are faced. By pressing a hidden spring the arms spread out and become part of the bed. The two chairs are made into one elegant box spring mattress-bed, four feet wide and seven feet long. The entire car can be converted into a parlor car for the day run in less than a half hour.



Trolley Sleeper Showing Berths Made Up

The Railway Review says: The car is 56 feet 6¾ inches long over buffers and 8 feet 10¼ inches wide over side sheathing. The length over end sills is 48 feet 3 inches and the width over the side sills is 8 feet 9½ inches. The clear inside width is 8 feet 2 inches and the distance from the top of the rail to the top of the deck is 13 feet 4⅝ inches. It is driven by four Westinghouse motors of 150-horse-power each, making a total of 600 horse-power per car.

When you want anything and don't know where to find it, write Popular Mechanics.

Lathe Attachments

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Part I. General Introduction and Description of Divison Plate and Pointer.
Part II. Overhead for Lathe and Alternate Form of Same.
Part III. Milling Attachment for Rotary Cutters.
Part IV. Milling and Drilling Spindle.
Part V. Gear Wheels and Rotary Cutters.
Part VI. Suggestions on Changing Plain Lathe to Self-Acting and Screw-Cutting Lathe.

PART I.—DESCRIPTION OF DIVISION PLATE AND POINTER.

In taking up the subject of Lathe Attachments and appliances my object is to put before users of small lathes a few hints which will enable them to increase the variety of work that may be done on a lathe, as for example, accurately dividing a commutator for a small dynamo cutting gear and change wheels, fluting taps and reamers, drilling holes in difficult places, cutting key ways on shafts and numerous other work such as the amateur and professional workman will find confronting him more especially if he does model making or experimental work. All of the attachments described are in use in some form or other. The subject is not a new one either, for the process of working metals by means of circular cutters was known a century ago. Most of the small lathes in use possess a slide rest of some form and the attachments as a rule will to some extent depend upon this. The attachments will be described in such order as to enable them to be built by the user from castings or rough material at hand and if built in the order presented the attachment just finished can be used in the construction of the next in order. As a rule dimensions will not be given as each person who elects to make one or all of the attachments will be confronted with a different set of conditions, some possessing screw cutting lathes while others have only plain or speed lathes and while one may have a lathe of two inch centers, another will possess a five inch center lathe. The principles involved are the same in all cases and the user must suit the dimensions of the tool to the lathe it is to be used with.

The first attachment to be described will be a division plate and pointer, as some means of accurately dividing spaces on work held between centers, must be provided. If possessed of a screw cutting lathe this may be accomplished by using the change wheels fixed in the usual place and a pointer attached to head stock in any convenient manner. For instance a gear blank is to be divided into 40 spaces. Use the 40 change wheel. Attach the pointer so that it will drop into a tooth space. Make the cut on the blank held between centers. Release the pointer and revolve the work one tooth. Readjust the pointer and make the next cut, and so on until the job is finished. Many ways of fastening the pointer will occur to the workman. With a plain lathe a division plate is used. To make it procure a flat piece of brass 3-16 inch thick and of greater diameter than the large pulley wheel (b Fig. 1), fasten it to a wooden face plate

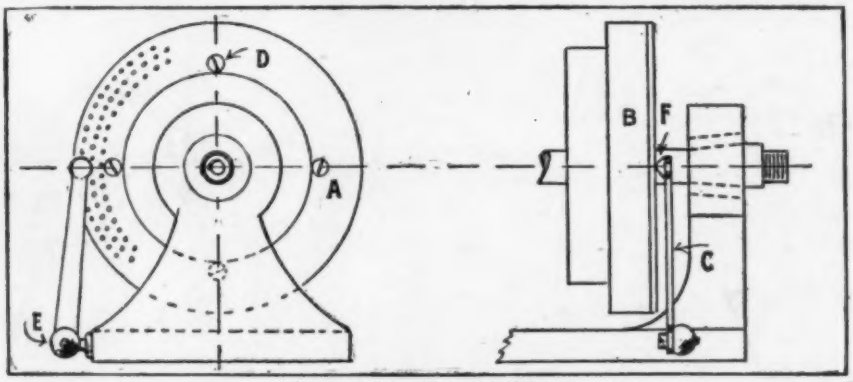


Fig. I. Division Plate and Pointer.

and, using a narrow parting tool, cut a central hole just large enough to slip over the lathe mandrel without shake. Next rough out the circumference so that you have a washer or ring a little larger in diameter than the large pulley (b. Fig. 1). Remove the large pulley and mandrel from head stock and slip the brass ring over the mandrel and flush against the large pulley. Fasten it with four counter sunk brass screws (d Fig. 1) to large pulley. Readjust mandrel and pulley, with ring attached, in head stock and, using a hand tool, finish off the circumference even with face of pulley and true up the side face of ring. Next, using a sharp pointed tool, scribe lightly three or four concentric circles on side face of ring. Remove ring from pulley and mandrel and using a pair of dividers, divide the concentric circles scribed on its side face into the number of spaces required. Use a small center punch and be sure that the spaces are equidistant from each other. The holes should be drilled with a 1-16 inch twist drill ⅛ inch deep and preferably in a small sensative drill running at a high speed. I use four sets of holes as follows: 360, 180, 112 and 96, but one row of 360 will do most of the work required. When holes are drilled the washer may be returned to its place on mandrel and secured in position with the countersunk screws (d Fig. 1), and it is a good plan to file a small notch in face of washer and pulley before removing washer to be drilled so as to get it back in its exact position. The pointer (C Fig. 1) is next made of thin steel or hard springey brass. A hardened steel cone (f Fig. 1) is made and fitted to the smaller end and the larger end is drilled to recive a screw which holds it securely to the ball show at "e" Fig. 1. E, Fig. 1, is a ball or circle turned from one inch brass rod with a flat filed in the side and drilled and tapped ¼ inch to receive the screw for holding down pointer, and a shouldered projection is screwed ⅝ inch to screw into head stock, as shown in sketch.

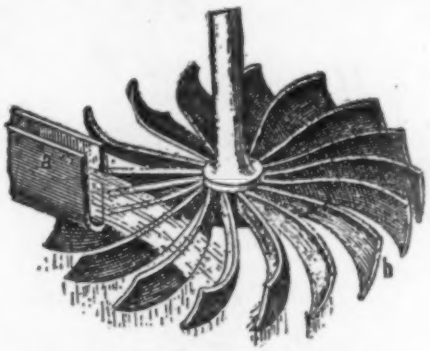
If the side face of large pulley is wide enough, the brass plate may be dispensed with, the holes being drilled in pulley.

The next article will take up overhead attachments used for driving circular milling cutters, drilling, etc.

During 1903 the United States produced $234,500,000 worth of electrical apparatus and machines used in connection with electric plants and workings. Among some of the larger items which comprise the list gathered by the Western Electrician are: Arc lamps, $1,900,000; cables, underground, aerial and marine, $19,700,000; dynamos and motors, $52,000,000; telephones and accessories, $19,500,000; wire, bare, $18,350,000; wire, covered, $17,000,000; cars and trucks for electric railways, $7,500,000; incandescent lamps, $5,400,000; storage batteries, $5,000,000.

TURBINES USED 2,700 YEARS AGO.

The turbine, of which we hear and expect so much in these days, is by no means an idea new in mechanics. Twenty-seven hundred years ago, in the little nation of the Chaldees, adjoining Armenia, the water turbine was known, and built and used in milling. It was then called the "shell wheel." The wheel was used in a horizontal position, no effort being made to secure the greatest value of the water pressure,



THE OLDEST TURBINE.

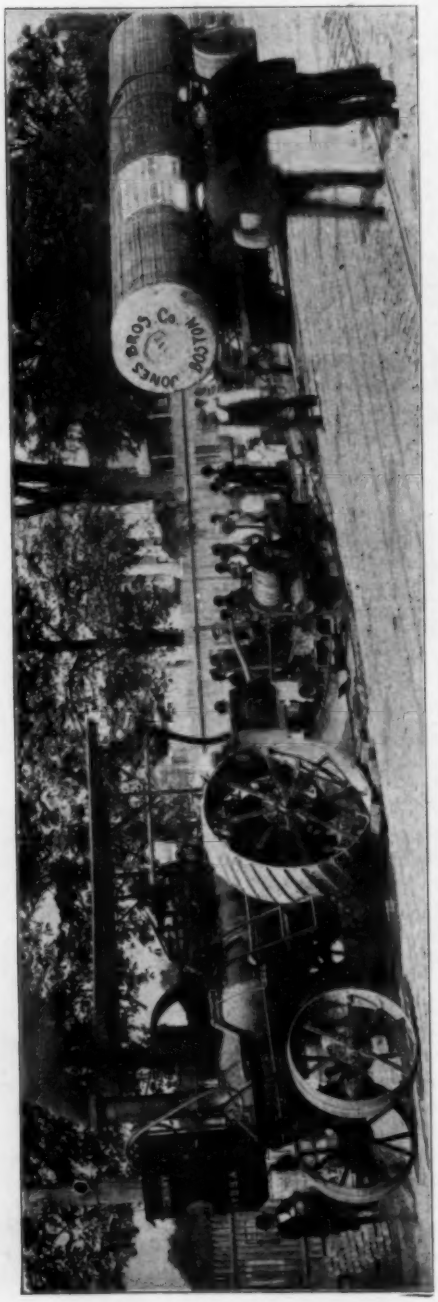
and the wheel connected to a vertical shaft which turned the stone and ground the grain into a coarse flour.

Near the city of Van, believed to have been built 2,000 years B. C., there still remain canals in a good state of preservation. One of them, 60 miles long, is now used for irrigation and power. At one time, centuries agone, there were 40 mills on this canal, and today the remains of these ancient institutions may be seen. Flour mills, driven by these simple turbines, of the same type as was used there 2,700 years ago, are still in operation.

The Deutcher Mueller, Berlin, says: "These turbines were brought to the notice of the modern world and quite generally adopted in Europe from 1750 to 1830. These Chaldees are not to be confounded with the Chaldeans of Messopotamia."

Largest Columns America Ever Saw

Colossal Granite Pillars for the Cathedral of St. John the Divine Hauled Through New York



Moving Through the Streets of New York, the Largest Granite Column Ever Quarried in America

Solid granite columns 37½ feet long and 6 feet in diameter, the largest single pieces of granite ever quarried for building purposes in America, were recently hauled through the streets of New York to the site of the new Cathedral of St. John the Divine, now in course of construction. The use of such huge monoliths in a modern building is a radical departure from existing practices and is enough to make the architect wonder if our building customs are reverting back to the times of ancient Egypt and Rome, the remains of whose constructions are yet the marvel of the world.

Eight granite columns, the most massive ever used in a modern building, are being placed in the interior of the great New York Cathedral. Each of the eight columns is in two sections, the lower of which is 37½ feet long and 6 feet in diameter and the upper 18 feet long and 6 feet in diameter. The larger sections weigh 90 tons each and the smaller 40 tons.

The original contract, according to the Monumental News, required that the columns each be made in one solid piece 63 feet long and 6 feet in diameter. Two of them were broken in turning, however, and the owners modified the contract, allowing them to be made in two pieces.

For quarrying and polishing the huge monoliths a special lathe was constructed at a cost of $25,000. The cost of quarrying the eight columns amounts to $200,000. The church they are to adorn will cost $20,000,000, and will be the most magnificent edifice in America. The hauling of the columns to the building's site marked the advent of the traction engine into city haulage. It was found impossible to transport the pilars by means of any team or combination of teams, and so a powerful traction engine was brought to the rescue. Neither was there a truck or wagon in New York or in America strong enough to bear such an enormous weight and so a special truck was constructed for the task. It is the largest and most powerful wagon ever built in America. It is capable of carrying 150 tons. The front wheels are 2 feet 11 inches in diameter; the rear wheels 4 feet 3 inches in diameter, both having a

20-inch tire of 1-inch steel, the wheels being made of 3- inch oak securely bolted together. The front axle is 7-inch square steel, the rear axle 8-inch square steel.

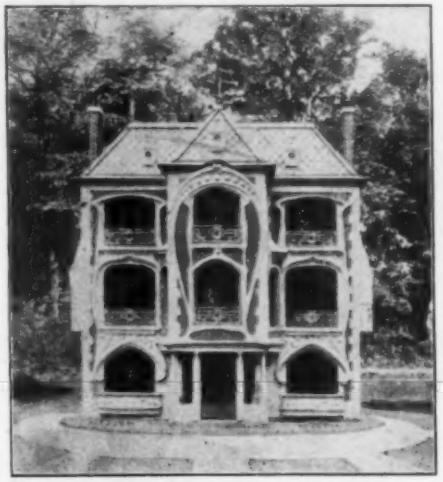
The traction engine was aided in its task by a steam winch by means of which the wagon was pulled with the assistance of wire rope, blocks and tackle.

The columns are of Fox Island granite. They were quarried and polished at Vinalhaven, Maine, and were transported to New York by water directly from the quarry, being conveyed on the deck of a lighter.

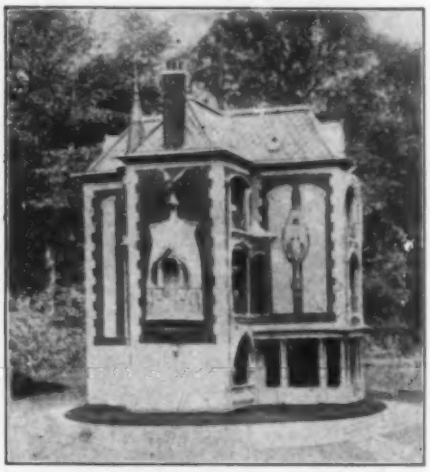
The building of the great Cathedral of St. John the Divine, which probably none living will ever see completed, was described in a previous issue of Popular Mechanics. The work has already been in progress twelve years and it may be 100 years before it is finished.

"HOUSE THAT FOLLOWS THE SUN."

A "house that follows the sun" is the ingenious conception of a French architect, M. Eugene Petit. Several of them have already been built in France. The houses



Position of the House at 11 a. m.



Position of the House at 5 p. m.

can be made to always front toward the sun. They revolve on a pivot which is turned mechanically. The principle is that of the turntable. Two men can easily revolve the house. The introduction of water, gas and electricity is ingeniously contrived.

Wireless communication has been established between Japan and Formosa.

COPY AMERICAN RAILWAY APPLIANCES.

American railway appliances are being copied in Europe and Asia. First there was a thorough test of these appliances, and they having proved successful the equipment of several important railways are to be changed so as to conform to American models. In Bavaria the government has decided to construct a large number of new locomotives after the model of approved American makes and in India the government is preparing to introduce heavier locomotives and cars, after standard American types. These are but two of a number of similar instances. It is believed that these changes will open up a larger foreign market for American manufacturers of railway supplies than they have yet enjoyed.

SIZING OF WARPS IN THE LOOM.

Loom warps that have been insufficiently sized may be so corrected in all except the worst cases without the necessity of taking the warp from the loom. A soft rope about an inch in diameter is stretched across the loom between the reed and harness, so as to rest lightly on the warp. This rope is saturated with a solution of dextrin. During the movement of the rope backward and forward the warp absorbs more or less of the solution and is thus sized and made stronger. The sticky rope picks up the loose hairs, knots and flyings from the yarn which is thus left much cleaner when passing through the reed.

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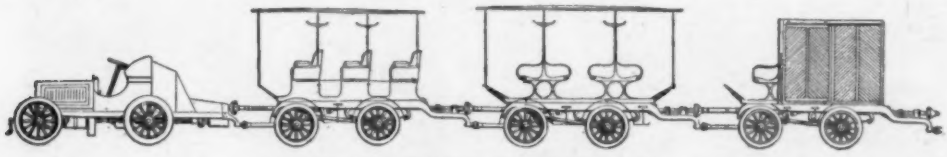
THE AUTOMOBILE TRAIN.

France continues to spring surprises in automobile construction and invention. Following the automobile house, described and illustrated in Popular Mechanics of October, 1903, comes the automobile train. This differs from the regulation train of steam cars, not only in requiring no expensive track on which to run, but the motor car transmits power to each of the other cars, making all of them tractors.

Under each car is a shaft extending its entire length, and connected to the car ahead and behind by a universal joint to permit of turning curves and traveling grades. The power thus transmitted from the motor car is by means of gearing under each trail car transmitted to the wheels, and thus each wheel in the entire train is made a driver. The system is known as the Renard, says Motor Age, and the motor car has a gasoline engine of 60-horse-power.

The train comprises four vehicles, the motor, two passenger, and one baggage car.



Showing Mechanism of Automobile Train.

A detachable motor and propeller, manufactured in France, can be placed in a boat and removed at will, or transferred from one boat to another.

3,000-MILE OCEAN RACE.

An ocean race over a course 3,000 miles long is now in progress. The contestants are two sailing schooners which have sailed from Providence, R. I., to Brava, C. V. I.

The Sarah A. Lee is a 74-ton fishing boat 83 feet long, carrying 37 persons in crew and passengers, of whom four are women. The other vessel, the Unique, is about the same size and has 40 persons aboard.

The boats will endeavor to follow the same course to the Bermudas, where a landing will be made. After leaving there each will select its own course.

First Appearance on the Streets of France of the Renard Automobile.

Wheeled Blacksmith Shop for Use in Battle

Equipped to Repair Artillery in the Heat of An Engagement and to Travel with the Army

A blacksmith shop on wheels for repairing cannon, gatling guns, gun carriages and everything pertaining to the artillery is the latest addition to the United States army. In the heat of battle, when artillery pieces become impaired from any cause, the movable blacksmith shop is ever in readiness to make speedy repairs, that the guns may quickly resume their work of death.

War Blacksmith Shop on Wheels

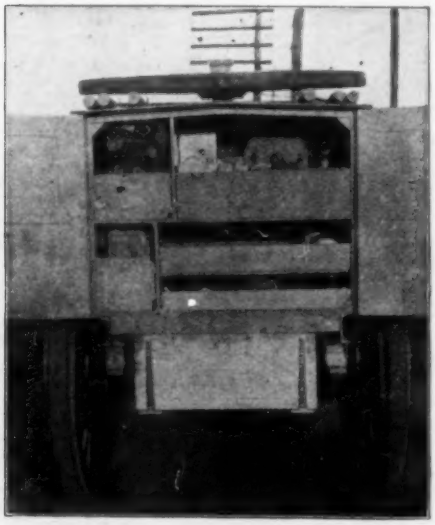
The wheeled shop is called a battery wagon. The United States is the only nation in the world to possess such an acquisition, and its service in actual warfare will be of inestimable value. In every battle that has been fought with artillery since the cannon ball's deadly work first was known, there has been a crying need for just such a contrivance, but it remained for an American to think out the conception and perfect the invention. How many times has an army been weakened through the disablement of its artillery? How many times has a general been forced to surrender because his cannon were no longer of service? History records many instances, and there are probably many more that have never been chronicled. With the battery wagon to have hurriedly placed the disabled artillery again in action history might tell a different tale in its accounts of numerous battles and it might have changed the fortunes of wars.

The battery wagon might be called an army automobile blacksmith shop. It is a huge automobile equipped with all the tools of a blacksmith shop needed for artillery repairs. There is an anvil, a forge, a lathe, emery wheel, grindstone, vice, dynamo for lighting at night and other service, and an abundance of other tools, including hammers, wrenches, files, etc.

The wagon was built for the United States government by the United States Long Distance Automobile Company. It weighs about five tons and is driven with a four-cylinder gasoline engine. The front wheels are 48 inches in diameter and the rear wheels are 56 inches. All the wheels

are fitted with solid rubber tires. The machine has four speed changes forward and reverse, and is geared to run at a maximum speed of about ten miles per hour. It is arranged with drawers and compartments to carry all the small tools and appliances.

The machine attracted great attention when it recently traveled from New York

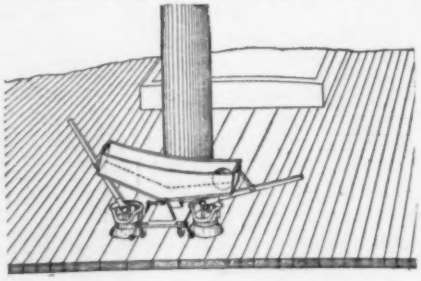


Rear View of the War Blacksmith Shop

to Washington, making the trip without a single mishap. All along the route people gathered to see it and to marvel at its unique appearance. European publications have sent representatives to America to describe the device, and the probabilities are that it will be imitated by many nations and become an established addition to all armies of the world.

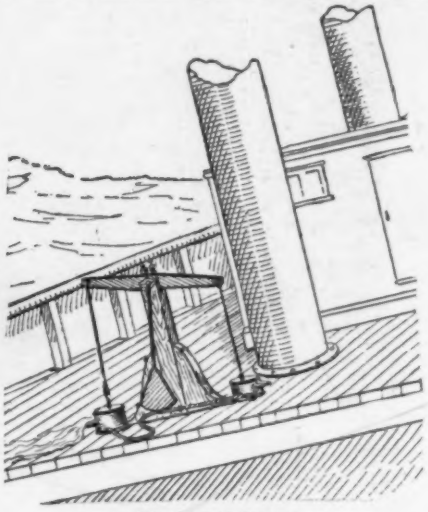
SELF-PUMPING DEVICE FOR SAILING VESSELS.

It is during a storm that a ship starts a seam and begins to fill with water. If it be a steam craft the men have only to put the pumps in motion, but if it be a sailing craft the case may be very different. In the large sailing craft now built the vessel is supplied with steam power for hoisting the sails, steering, heating, electric lighting and pumping, but thousands of older craft are still afloat where a bad leak in a storm means a battle to the death between the water in the hold and the men on deck working the hand pumps. Many a gallant crew has pumped for days only to fall exhausted and go down when a few hours more would have meant safety.



Bradley Pump

Inasmuch as the greatest need for working the bilge pumps is when the ship is rolling in a storm, G. Foster Howell, of the American Shipbuilder, New York, has invented an automatic pump, one which operates itself by gravity. The worse the storm the more it pumps. Two weights are hung to a walking beam, and as the ship rolls (it rolls more than it pitches) these weights



The Howell Pump

which are hung like pendulums work the beam which with the top of the pump is shown above deck. The pump will work in a stroke of only 2¾ inches, but will raise 60 gallons per minute. The beam is 5 feet long, and the weights 100 pounds each.

Another member of the staff of the same paper has also invented an automatic pump. It consists of a rocker 5 feet long, 12 inches wide and 12 inches deep. In the rocker is an iron ball weighing 100 pounds. The rocker is pivoted in the center and attached to the pumps. As the vessel rolls the ball rolls from one end to the other and in doing so works the pumps.

Logging in the Jungles

Menagerie of Animals and Barbaric Natives Employed About the Queer Sawmills

Lumbering in the jungles, where all kinds of strange looking animals are employed to do the hauling is an occupation very interesting to look upon, but sometimes fraught with great danger to the workmen. A veritable menagerie is often found about the sawmills in Assam, India. Elephants, yaks, zebus, Madras oxen, etc., are used to load the logs on the skidways, to load and haul the trucks and tram cars and do various other jobs of lifting and pulling. The elephant and the zebu are the most valuable of these animals. The elephant may be said to take the place of the American tram engine or "dinkey," and the zebu performs the work of the ox or mule. The natives, half clad and uncivilized, seem as wild and strange to the American tourists as the animals employed about the sawmills. In penetrating the thick, wild woods for timber, dangerous wild beasts and poisonous serpents are often encountered. The woodsmen are always armed and many thrilling escapades can be related by nearly all of them.

One of the illustrations shows a scene at a logging camp of the Sissi sawmills, of Dibrugarh, province of Assam. The clear space is surrounded by dense thickets and the logs are brought from the woods miles away. The elephants are lifting the logs onto the tram cars by means of the crude appearing crane and the native Indian oxen are hauling them to the mill. The other illustration shows the elephants and natives entering a dangerous jungle in quest of timber.

Entering a Dangerous Jungle in Quest of Timber Near Sissi

The Lumber Review, which scours all the world in its search for information regarding the lumber trade, says: "Up to a comparatively recent period timber cutters, charcoal burners, and the like, were allowed to destroy the timber of Assam much as they

pleased. The English government, at that time, devoted its energies merely to the extension of cultivation, foolishly taking no heed whatever of the waste which was going on. The Assam forest service was subsequently instituted and from that time indiscriminate timber cutting has been prohibited. The black men are forbidden to burn the jungle, wholesale, as they had done before, and every means has been taken toward securing a continuance of timber growth."

Before the action related to was taken by the English government, the uncivilized natives of Assam would set fire to miles of the jungle to drive out wild game and would entrap or shoot the animals as they fled from the flames. Great trees of the finest woods were often consumed by these flames. The largest of the trees near the settlements were often destroyed by the charcoal burners, the natives finding a ready market for the charcoal among the English inhabitants.

Log Lifting Station on the Sisal Property

LIMIT IN EMERY WHEEL SPEED.

Tests made recently by Prof. Grubler of Dresden, to ascertain the speeds for running emery wheels demonstrated that no wheel stood more than 4,340 revolutions per minute. Most wheels broke into four quandrants—none into two pieces.

POWERFUL AUTO COMES OVER FROM FRANCE.

A revelation to America is the 180-horsepower racing car brought over from Paris by the American Derracq Automobile Company. The car has two four-cylinder motors, each of 90 horse power, one mounted over the front axle and the other over the rear axle They are connected in such a way that they can be run simultaneously, driving one main driving shaft or so that one of the engines can be operated to drive the car and the other left idle. Bevel driving gears are used and operate noiselessly. There are only two inches clearance from the ground and the supports of the body are in the form of skids or runners, so that when a tire bursts or a wheel breaks the car remains upright. The body of the automobile is boatshaped and so roomy that the driver can get his entire body and head down inside of it if disaster threatens. The interior of the body surrounding the driver's seat is thickly upholstered to protect the operator against bruises and possible break age of bones.

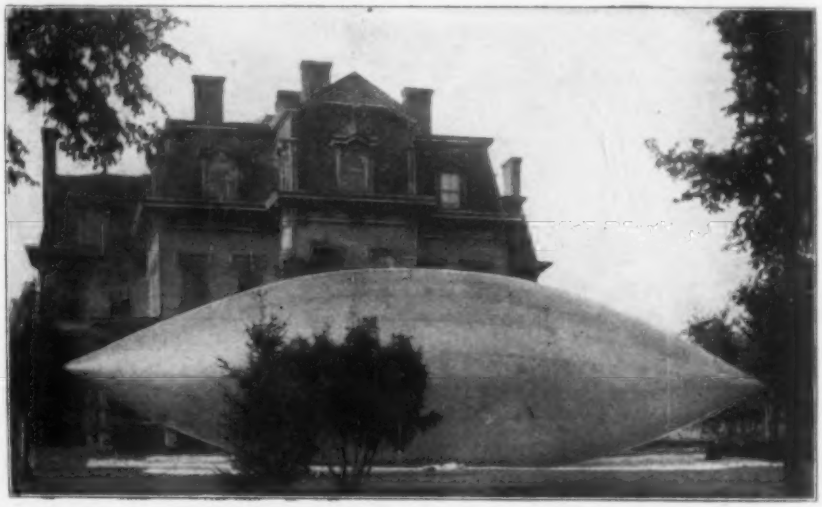
A weighing attachment has been invented; intended to be placed in a refrigerator, and which shows at a glance how much the cake of ice weighs, either when first put in, or at any subsequent time.

Airship Factory Builds a Queer Craft

Interest in Coming Races and Recent Successes Causes Wonderful Activity in the Aeronautical World

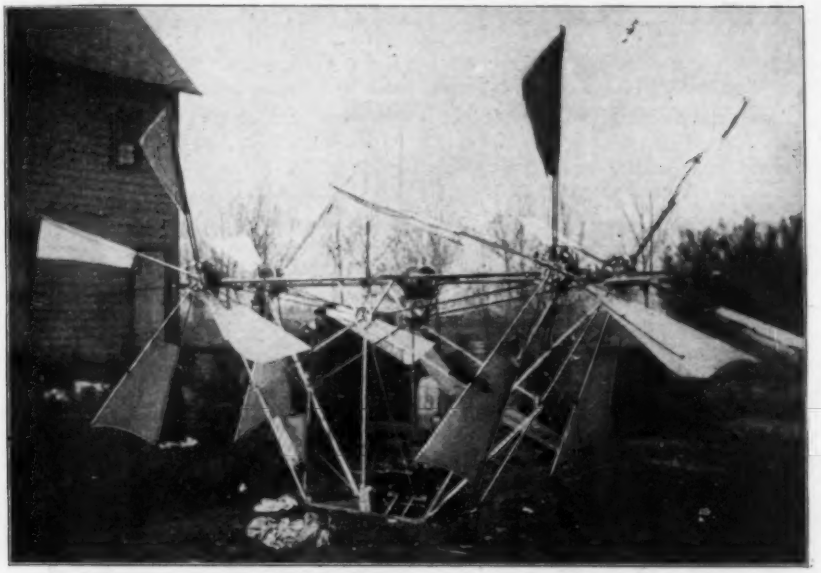
Given impetus by the coming international aeronautical races and the recent aerial achievements in Europe and America, aeronautics enter into the year 1904 with more general interest and greater prospects of success than it has ever been able to claim before. The new year dawns on energetic airship building in many different parts of the globe; men and factories are laboring night and day, and many a mechanic and scientist is hurriedly finishing his airship plans lest some rival beat him to the goal and claim the honor of making aerial navigation practicable for all. It is the general impression among scientists that the world is on the eve of realizing the dream of general air traffic, and recent performances of aeronauts make their convictions well founded.

Aside from the many individual builders of airships in America, a regular airship and balloon factory has been established at Frankfort, N. Y., and there many strange-looking aerial crafts are now in progress of construction. Among these are airships that will doubtless contest for the $100,000 prize offered by the Louisiana Purchase Exposition in the aerial races. One, the product of a Montana inventor, T. C. Benbon, reveals many remarkable features that may cause it to enjoy notable prominence before its career is far advanced. The Benbon airship, which is the very latest American effort, is shown in the accompanying illustration. This craft has already been tested and, though its inventor is endeavoring to keep its performance secret, it is well known that the airship demeaned itself most successfully; it was guided at will, flew against the wind, up and down and in any direction desired and was safely landed at the appointed location. By improvements and additions it is believed this device could be made to carry several



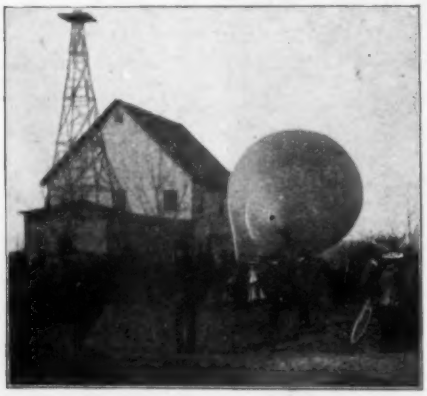
Side View of the Montana Airship of T. C. Benbon, as Seen at the Airship Factory—Length 74 Feet, Greatest Diameter 21 Feet, Gas Capacity 14,000 Cubic Feet, Lifting Capacity 850 Pounds

Bow View of the Benbon Airship Inflated, in the Yards of the Airship Factory



Framework, Car, Paddlewheels and 10-Horsepower Motor Weighing 110 Pounds

passengers safely. The craft is 74 feet long, 21 feet in diameter and holds 14,000 cubic



Preparing the Bonbon Airship for Ascension at the Airship Factory

feet of gas. When inflated, it is said, the balloon has a lifting power of 850 pounds.

Group of Large Balloons Filled with Hydrogen Gas, at the Airship Factory

It is propelled and steered by four revolving paddle wheels whose sails open or shut at any point during each circuit to force the sharp pointed vessel upward, downward, to the left, or right, and forward or backward, actuated by a 10-horse-power 4 cylinder gasoline motor, weighing 110 pounds.

The airship factory is operated by Prof. Carl E. Myers, himself a well known aeronaut, whose recent constructions, as related in Popular Mechanics, have won wide distinction.

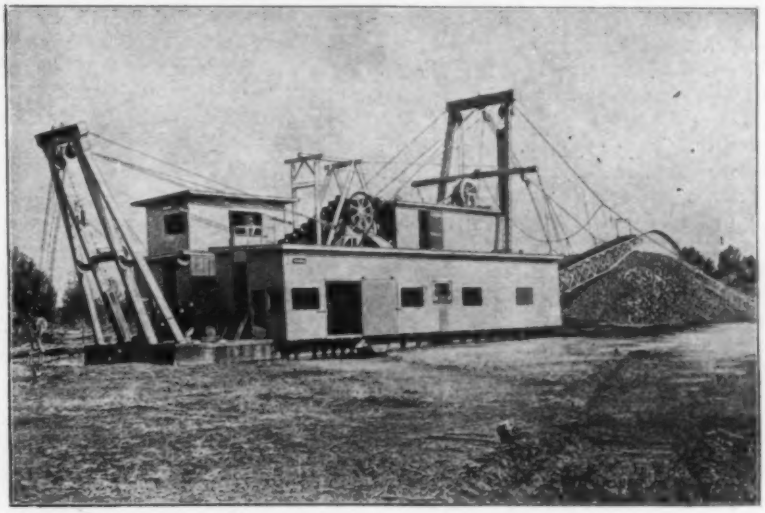
Air ships for the coming races are being built in San Francisco, and other parts of the country and over in Europe the interest is equally as great.

Prof. Myers has been appointed superintendent of the aeronautic grounds and buildings at the St. Louis Exposition.

Among Prof. Myers' other duties he will establish and conduct a shop in the aeronautic grounds for making repairs to balloons and airships and any new constructions which may be required. He will make and operate the signal balloons used for marking the course in the grand races, will have charge of the operation of the hydrogen gas plant and will conduct the races under the direction of the international jury. A gas plant for the manufacture of hydrogen will be built. There will be pipes and valves for the inflating of ten balloons at once. There will be a balloon testing building 80 feet high and a large structure for the use of airships.

Gold Dredge Digs Wealth From Sands

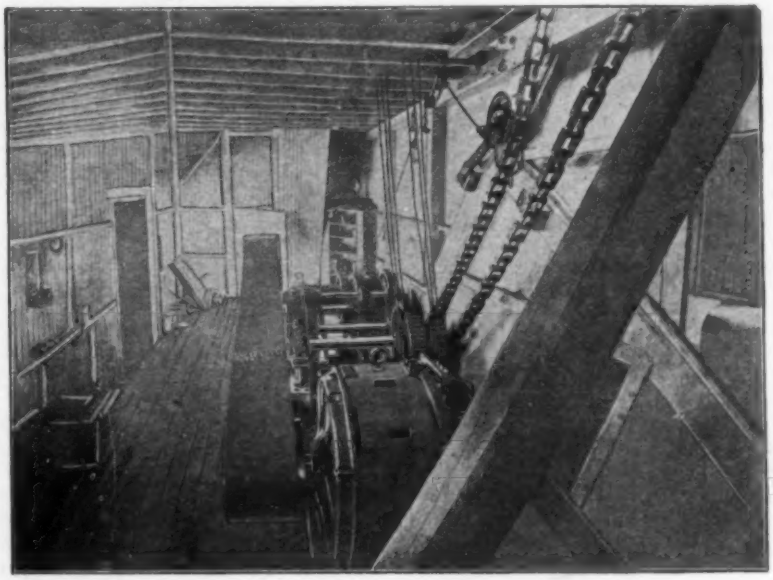
New Electrical Device Sifts Out the Finest Particles of the Metal and Makes Abandoned Districts Valuable



An Electrically Operated Gold Dredge

Gold found in the sands of America's western streams is being extracted by electrical methods that are proving the vast wealth of many districts long regarded as unprofitable. The electrically operated gold dredge is the machine that is sorting out the fine dust of gold from the sands and piling it up in big paying quantities.

The electrical dredge possesses many advantages that explain its remarkable success



The Gold Dredge—Interior View, Showing Westinghouse Induction Motor Driving Dredging Buckets

in extracting gold from sand. It can be operated where fuel is difficult to obtain, which is frequently the case where gold sand is found; is works as well at night as at day, and its equipment for separating the gold is such that no particle, however small, escapes.

A gold dredging apparatus recently installed in California consists of two 180-kilowatt belted alternators, which are to be driven by water wheels; two variable speed induction motors with controllers, one of which drives the bucket line, the other the conveyor; two standard induction motors for driving the pump, one of 20-horse-power, the other of 50-horse-power, and a 15-horse-power motor for operating screens.

A gold dredge consists of the dredging machine paper and the pumping apparatus which supplies the necessary water for washing and sluicing. The dredging machinery comprises a chain of electrically-driven buckets which pick up the material, a steel hopper into which the material is emptied, a revolving screen designed to receive and wash the excavated material, an appliance for carrying off all the coarse tailings and stones that are rejected by the screens, and a sluice-box in which the water and fine material containing the gold are disposed of, and in which the gold is saved. The stone chute is of a sufficient height and inclination to discharge the material clear of one side of the boat, so that no obstruction can take place on account of the accumulation of tailings. From the under side of the screen all the fine material, including the gold, is discharged with a considerable quantity of water—all of which is carried off and over the stem of the dredge through a sluice-box containing a series of riffles, in which the gold is caught, and of a length sufficient to carry the tailing clear of the dredge to save all the gold. When the gold is of too fine a character to be efficiently collected in the ordinary sluice-box, a finer screen and gold saving tables are employed.

FRANCE TO TEST WIRELESS TELEGRAPHY.

Two wireless telegraph stations are to be established near Paris for the purpose of training Frenchmen in the art of sending and receiving wireless messages, as well as to thoroughly test the practicability of the new discovery.

WHY DO MATCHES BREAK?

Have you noticed how easily the ordinary match, most generally used, breaks? You pick one up to light the gas or a cigar, and snap! off goes the head or half the stick, leaving only a splinter in your hand. You repeat the process, and if in a hurry or a trifle impatient at the annoyance, you will likely break two or three matches before you succeed in your purpose.

Has it ever occurred to you there was any special reason for all this breakage and waste?

The old fashioned black headed sulphur match, however abominable with its choking fumes, was an honest match.

But there were no trusts then.

The matches of today are not honest, respectable matches. They are not "straight" goods. They are cut on a "bias."

When the block of wood from which they are cut is fed into the machine which makes matches by the wagon load every day, it is not fed straight with the grain, but at a slight angle. The result is a substantial enough appearing match, but there is no strength there and it will break with the slightest pressure.

Take your penknife and split a few lengthwise and see how many will split straight and true. Not many for the grain is crooked. Did you ask how this happens?

If one man breaks three matches in one day, how many matches do all the men, women and children in the United States break in a year? And every match they break creates a sale for just one more.

The homely old black match was not made by a Trust, but it was a straight, upright, well behaved match that did not fly to pieces and burn our fingers and set the house afire.

EIFFEL TOWER COMING DOWN.

The Eiffel tower, known all over the world, will be immediately torn down; that is if it does not fall of its own weight before the workmen can dismantle it. Already it has begun to lean to one side to an alarming degree, as a result of the settling of its foundations. The tower is 1,000 feet in height, and was the distinctive feature of the last Paris World's Fair. Its owners had a concession until 1910 but do not expect to be able to strengthen the tower so it would be safe to use.

Passing of the Old Type Bessemer Converters

New, and Improved Style Being Substituted--Description of the Process

The old type of Bessemer converter is rapidly being supplanted by the new Bessemer type in modern steel works. At the Minnequa works of the Colorado Fuel and Iron Company the converter that had been employed there for many years has just been demolished to give way to one of late design and improvements. The interior of the old converter is shown in the illustration. The air blast which burns the impurities out of the pig iron was turned on when the picture was taken. The blast is shown by the flames extending upward from the mouth of the vessel. The ingot molds, into which the molten steel is poured, are shown at the edge of the pit. When the metal has solidified the molds are lifted off the ingots, which in turn are conveyed to the blooming mill.

Interior of the Old Bessemer Converter, Minnequa Works, Pueblo

By the Bessemer process steel is made from pig iron by burning out the foreign impurities and replacing the requisite

amounts of carbon and manganese. The molten iron to be converted into steel is placed in a large receptacle, the converter proper. This is a spherical vessel lined with fire clay, the bottom having numerous holes, through which a powerful blast is driven during the process. The blast of air thus blown through the molten pig iron decarburizes it and converts it into steel. By this method the foreign substances—silicon, carbon and manganese—are burned out. The proper amounts of carbon and manganese are replaced by mixing the proper portion of spiegel with the molten pig iron. The molten pig iron that is poured into the converter is obtained by melting it in cupolas, called the cupola process, or by taking the iron directly from the blast furnace, called the direct process.

Converts Peat Into Coal by Electricity

New System That May Bring the Millions of Tons of Buried Fuel Into Practical Use

By William H. Mason, United States Consul-General

By a German process peat is coked in retort ovens heated by the flame of the burned gases generated by the coking process itself. This method is practically self-sustaining, produces coke of high quality, and aside from the difficulties of cutting and excavating peat under intense cold, can be worked during the winter in even an arctic climate.

At the works of Messrs. Johnson & Phillips, at Charlton, in Kent, England, there has been exhibited during the past fortnight an electrical proces for converting ordinary peat into firm, smokeless steam coal at a cost which promises to bring the product far within the price limit of steam fuel in Great Britain and Continental Europe.

The peat is cut and excavated by machinery, loaded into dumping cars which convey it from the bog to the plant, where it is packed into rotary iron cylinders of a peculiar construction. The cylinders being rotated at high velocity, the centrifugal pressure, aided by an interior beating device, expels all but a small remnant of the 80 per cent of water which the material originally contained. Electrodes connected by conductors with a dynamo are then inserted in the cylinders in such a manner that the mass of centrifugally dried peat becomes the medium through which is completed the circuit between the electrodes. The resistance offered by the peat, like the filament of an incandescent lamp, generates heat which carbonizes the material, producing a mass of distintegrated black globules, which retain all the valuable elements of the original material. This part of the process, which depends largely upon the conductivity of the peat, may be promoted by moistening the mass with certain cheap liquid chemicals, the use of which is covered by the patent.

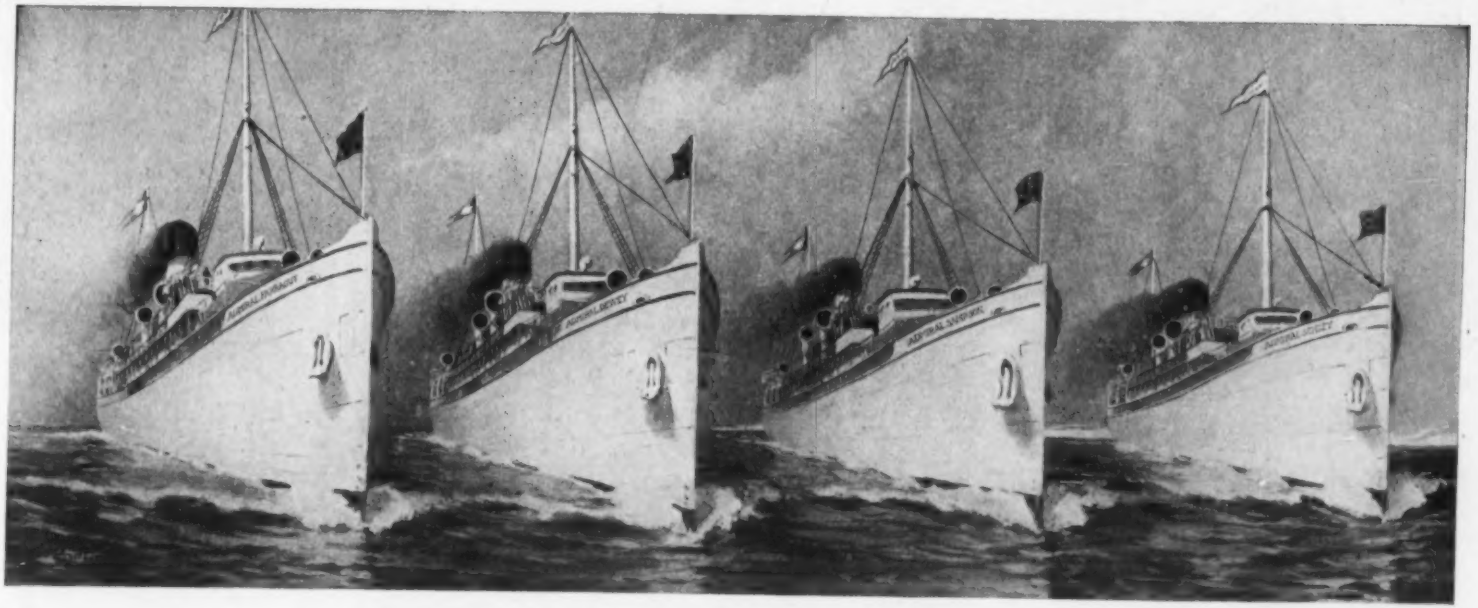
From the cylinders the carbonized material pases to machines, which knead it into a puttylike mass, which is then pressed into briquettes or left to dry and harden in masses, which are broken into lumps, screened and graded like ordinary coal. Among the special advantages claimed for this method is the fact that the electrical current converts but does not destroy any of the valuable elements of the peat, whereas coking by fire heat expels a large percentage of these elements in the form of gases, which, being either wasted or burned as fuel beneath the retorts, are lost from the composition of the ultimate product.

Briquettes produced by this method can be compactly stowed on shipboard or elsewhere; they are practically smokeless, leave no clinkers at all, and have the high thermal value of 9,000 British units. The cost of a plant capable of treating 100 tons of peat per day is stated to be $19,500. The actual cost of producing one ton of peat fuel by this process is stated to be $1.21, equal for all steam-generating purposes to a ton of South Wales steam coal, which costs at the mouth of the mine $2.02. These are given as the economic results in a location where the electric current used by the process is generated by steam. In districts where generators can be driven within a working radius of peat bogs by water power, the cost of production would be proportionately reduced.

There are in New England and in the Middle and Western States vast beds of peat which have been heretofore left neglected as waste material in the economy of nature.

The "Four Admirals" of the Tropics

Splendid New Steamers That Carry Tourists to and from Jamaica



The Admirals Farragut, Dewey, Sampson and Schley

"The Four Admirals," as the four new steamers of the United Fruit Company's lines are termed, are splendid types of the improved passenger service that is resulting with America's constantly increasing interests in the tropics. The new boats are the Admirals Farragut, Dewey, Schley and Sampson. They are strictly "four of a kind," being identically alike in all details. The admirals are American twin-screw steamers, and each has been enlisted in the United States mail service. They ply between the United States and Jamaica, the tropical wonderland that is now attracting so many American tourists. The Admirals Dewey and Farragut ply between Boston and Jamaica, and the Schley and Sampson between Philadelphia and Jamaica. All are elegantly equipped, modern steamers and are as attractive in their artistic appearance as in the many comforts they offer.

Coal Dock Operated by Electricity

Pioneer Fuel Company's Dock Property at Duluth, Minn. One Mile of Water Front. Area Two Million Square Feet Electrically Equipped Throughout

ELECTRICITY VS. THE STEAM ENGINE

Great Coal Docks Now Use Motor Drives for General Power—Their Economy and Multifold Advantages

Electricity as a motive power is making its way into all kinds of industries for all kinds of purposes and is adding immensely to America's supremacy in the engineering arts, gained through tact in the adoption of labor-saving devices. The enormous saving in fuel consumption, lessening the loss from friction, economy of space and thousands of different applications and convenience that electricity offers over other methods of power transmission, together with the immense saving in labor, furnish the logical sequence as to why Americans are so rapidly turning to electric power transmission as the most certain factor in the accomplishment of their aims.

In a coal dock, where there is "coal to burn," it seems economy of fuel would not be an important consideration, yet many of the foremost coal yards are now adopting electricity as a motive power. The convenient manner in which the electric power can be distributed offers many advantages over a centrally located single prime mover. The electric drives are used to operate the tramways, to move all the hoists, derricks, etc., in loading and unloading the coal, to do all the repairing required, and, in fact, to run all the machinery of the immense yard. With the electric power already on hand new uses constantly suggest themselves as the mysteries of electricity are continuously being exploited and developing new uses, all to the additional economy of operating the plant.

The illustration shows one of the most perfectly equipped fuel docks in the world. It is the Pioneer Fuel Company's dock at Duluth, Minn. This dock has one mile of water front, and the yards and dock cover an area of 2,000,000 square feet. It is equipped throughout with electric motors.

WORK ON THE SIMPLON TUNNEL.

Work on the Simplon tunnel, under the Alps, goes on interruptedly with 10,000 men at work. This tunnel will be the longest in the world and will cost $14,000,000 or $1,000,000 per mile. It is expected that the tunnel will be open for traffic in 1905.

Popular Mechanics pleases all the family.

GERMANY'S NEWEST ACHIEVEMENT.

Electric Car Operated Without Converting High Pressure Alternating Current into Low Pressure Continuous

Germany has not only shown the world that a trolley car can be hurled along a track with absolute safety at a speed of 130 miles an hour, but in another test has demonstrated a great economy in the application of electric force. On the ordinary electric railway a high-pressure alternating current has to be converted into a low-pressure current before it can be transmitted through the trolley wire or the third rail to the motors of the cars. The process of conversion at various substations along the line has heretofore been so expensive as to make long distance electric travel financially impossible.

The motor used on one of the cars now running between Niederschonwiede and Spindlersfelde eliminates conversion. It derives its energy directly from an alternating current, which is carried along the trolley wire at 6,000 volts. There is no changing of current from alternating to continuous. There is no changing of voltage from higher to lower, while cost of conversion is saved.

URGE GOVERNMENT TO SAVE BIG TREES.

Government purchase of California lands growing the giant trees is being urged as a means of staying the wholesale destruction by the woodman's ax. Foremost in the movement is Captain Charles Young, acting superintendent of Sequoia and General Grant National Parks, in each of which is much land owned by private citizens. Capt. Young says the government should take immediate steps to purchase these private lands. He states: "The owners have grown tired of waiting. Where the big trees grow close to the country roads the owners have cut them down by the wholesale and put the lumber upon the market, so that where once was a fine forest of these magnificent giants there is now but devastation and ruin in the shape of stumps and sawdust piles on each side of the highroad. It is but just to the owners and for the best interests of the government that the purchase of these patented lands within the park limits be authorized by congress if the parks are to be continued."

Cost of Starting a Small Brickyard

Anton Vogt, an expert brickmaker, contributes an interesting article to Brick, the representative organ of the clay-working trade, from which we extract the following:

The extraordinary demand for clay products all over the country has turned the eyes of the big investors towards their manufacture. Statements of fabulous profits to be made in the brick business are quoted from mouth to mouth—brick can be made and loaded on cars for $3 per M. and they sell from $6 to $7 per M.; profit $3 to $4 per M. Given a yard with a 20,000 capacity per day the profit will be from $60 to $80 daily. This, of course, is on paper, and for the sake of enlightening intending clayworkers as to the actual figures of brick manufacture on a small scale we present a resumé of the equipment of the smallest kind of a brickmaking plant.

To begin with, if only a tempering wheel is used, this wheel will cost with freight about $125. Next a dozen molds must be ordered, three bricks in a mold, costing with freight about $20. While the wheel and molds are on their way from the factory, six pits must be dug, two for soaking clay, two for grinding and tempering and two for filling; these for a yard of 12,000 brick daily capacity. The digging of these pits will cost $30 inclusive of the laying of the floors, the lumber for which will cost another $54. Six hundred feet of 1-in. lumber are required for each pit at the rate of $15 per M. ft. Two carts for hauling the clay will cost $80 and a pair of horses or mules to haul and temper the clay can be obtained for about $200. Then come the smaller items; picks, shovels, axes, hammer, saw, etc., about $20 worth. Two mud barrows $10; two sand barrows $7; two molding tables and sand boxes $12; running boards, hacking planks and lumber for covering about $40, and other small apparatus about $40 more. The harness and feed for the mules can be figured at $75. This makes a total of $693 for the outfit and then about $300 must be in hand for operating expenses. Briefly stated, then, no one should figure on embarking in the brick business on no matter how small a scale with less than $1,000.

Now let us figure how much it will cost per M. to make the first kiln of 100,000 bricks. Supposing the clay is bought at 25 cents per M., digging the clay, filling and tempering will cost 70 cents per M. inclusive of horse feed. Molding will cost 30 cents per M.; mud wheeling, 25 cents per M.; off-bearing with three boys, 30 cents per M.; hacking in the yard, 10 cents per M.; loading to the kiln, 20 cents, and setting, 15 cents per M.; casing the kiln, 5 cents per M. Coal or wood will cost $1 per M.; labor for firing, 25 cents per M.; loading in cars, 25 cents per M.; a total of $3.80 per M.

So far the figures would seem to show a fair profit in the brickmaking business, but the brickmaker has both an ally and an enemy in the weather department.

Suppose 12,000 bricks were molded today and ruined during the night, then the next 12,000 would cost twice as much or $7.60 per M. There would be simply no profit at that price and that is the figure which many bricks cost, less the setting and burning. One case in particular can be quoted where 200,000 bricks were made and the labor paid for and only 101,000 were set in the kiln on account of unfavorable weather conditions. Of course this 101,000 cost more by the time they were burned than their market value. These things happen in open yards without any shelter. It is, therefore, not advisable to make any bricks by any process without providing a suitable shelter for them after they are made. Six thousand bricks per day under shelter will bring more than 20,000 bricks laid out in an open yard at the mercy of the weather, but this sheltering costs money to erect, and this additional cost must be added to the sum estimated for the equipment of the yard as first mentioned. There is money in the brick business if the enterprise is managed right, but not so much as the amateur imagines or as the skillful manipulator of the black pencil on white paper is able to show.

This country is filled with brickyard graveyards.

A new material for joining pipes is called "leadite," because it replaces lead in many ordinary uses.

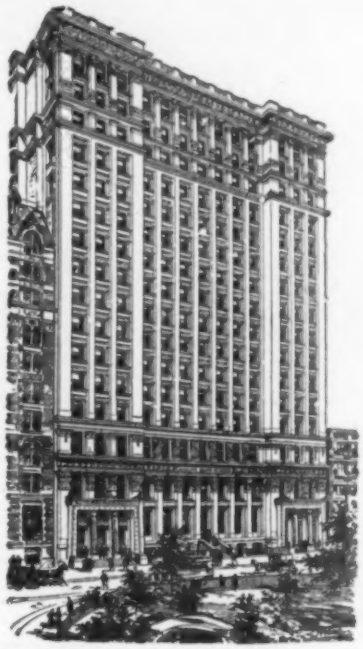
In Wisconsin a roof covered with sheet zinc in 1854 is still in fine condition and has never cost one cent for repairs.

Great Buildings of America

New York Structure that Reaches 380 Feet Above Ground and Contains 1,160 Offices

Thirty stories high, rising 380 feet above the sidewalk, and containing 8,000 tons of steel and 8,000,000 bricks in its construction, the Park Row building, New York, is the tallest and vies with the Monadnock building of Chicago in being the greatest office building in the world, despite claims made for newer structures. It towers like a great monument above the skyscrapers of New York city and is one of the first sights of the metropolis to be viewed by passengers of incoming vessels.

There are 4,000 piles supporting the structure, the foundation of which covers an area of 15,000 square feet. The foundations are carried 75 feet below the sidewalk to bedrock. First come the piles driven down forty feet. On these rest the grillage beams, which cross and recross one another, forming a firm foundation for the great piers. These are like so many backbones, extending from foundation to roof, sustaining the entire weight—walls, floors, everything. There are 2,080 windows looking out on the streets of New York, and 1,770 doors in the building. The exterior walls of the building are covered with 15,000 square yards or 3 1-10 acres of paint, and there are 16,000 square yards of paint on the steel frame. The structure is lighted with 9,500 electric lights. Power is furnished by three boilers of 900 horsepower. Ten passenger elevators carry the occupants to and from the 1,160 offices in the building.



The Highest Commercial Building in the World

ELECTRICITY FOR NOTHING.

During the recent electrical storm in the Northwest the telegraph wires developed some strange freaks. With all the batteries on the line cut out, the operators were able to telegraph between St. Paul, Minn., and Dickinson, N. D., a distance of 650 miles, by the earth currents. The American Telephone Journal says of the phenomena.

"Magnetic storms almost invariably occur during any period of solar disturbances, and just about the time of the recent Aurora disturbance, a group of unusually large sun spots made their appearance and slowly drifted across the disc of the sun. It has been so far substantiated that there is an intimate connection between solar phenomena and the magnetic condition of the earth that there is little doubt of the possibility of sending signals across inter solar space, and so Mr. Tesla's famous idea of signaling Mars is not theoretically impossible. The only difficulty seems to be to get an electric generator big enough to cause a disturbance great enough to be felt at so remote a distance.

Architect Siegwart, of Lucerne, Switzerland, has patened a new system of concrete flooring, consisting of hollow tubes of mortar and iron.

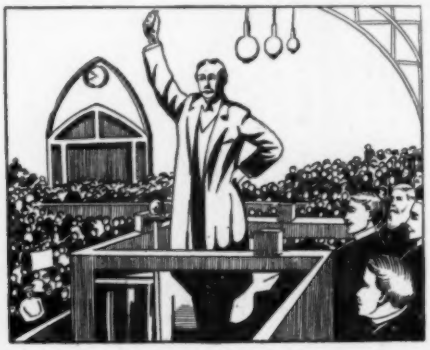
A Pittsburg concern announces an iron pipe which cannot be burst by freezing.

Popular Mechanics "is written so you can understand it."

ELECTRIC EARS REACH FAR.

Theatre, Opera, Lectures and Church Service in the Home

The English have certainly out-classed us in many of the utilities of the telephone. While we in America have talked about its possibilities our European friends have put the theory into actual practice.



Mr. Balfour Speaking While Telephones Transmit His Words Miles Away

In all the leading hotels, clubs, and many of the mansions of London, the guests or occupants have only to place the telephone receiver to their ears to enjoy the best entertainments in the city. It is even proposed to connect the House of Commons to the service so that all London may listen to the debates in parliament.

Thus far little attempt has been made toward a long distance service, but a recent test was so satisfactory there seems to be great opportunities. The time may not be far distant when the English traveler in San Francisco may listen to the prime minister as he addresses the House of Lords. The test mentioned was on the occasion of the speech at Sheffield by Mr. Balfour in which connection was made to the telephone company's office in London, and 24 journalists listened to the entire address. All took notes and several even made verbatim reports in shorthand.

Londoners Listening to Mr. Balfour's Speech Spoken at Sheffield

Toward the close of the address the speaker's voice became tired and many of those in the audience were unable to hear him. He apologized for not being able to make himself better heard, but miles away, sat the group of reporters who did not miss a word.

Four transmitters were placed around the speaker, upon an improvised hand rail so that in whichever direction he faced there was at least one transmitter to catch the speaker's words. These transmitters were all connected to the same long distance wires extending to London. A double receiver, one for each ear, was provided for the listener at the receiving end.

THE MACHINIST MUST BE A SPECIALIST.

The writer (in Locomotive Engineering) was in a railroad repair shop recently when the division superintendent brought in a typewriter to be fixed—said it was out of kilter. The foreman looked at it, struck a key or two, and remarked: I don't know much about these things." "Why," exclaimed the superintendent, "you have the reputation of being the best mechanic on the road; I thought you were just the man." The foreman turned to the speaker and said: "I am a locomotive repair machinist, and have carefully studied it for fifteen years; if you will bring me any job on a locomotive that I cannot do that any other mechanic can, I will resign, but life is too short for a man to spread himself out so thin as to attempt to be familiar with all classes of machinery. There are men who make a specialty of typewriters, as I do of locomotives. They can repair that machine in half the time, for half the money, and twice as well as I can. I would be as foolish to attempt to put new letters on that machine as the maker of typewriters would be to put a new tire on a locomotive."—

The proposed electric equipment of the Grand Central Passenger Station, New York, and the lines running into it for fifty miles, marks another victory for electricity in the fight it is waging with steam for the motive power of the railroads of the world.

America's Highest Mountain Peak

Mount Whitney, located in the Sierra Nevada mountains, Kerns county, Cal., has very recently been scaled, and a careful official measurement made of the altitude of that kingly peak.

The measurement was made by Professor McAdie, chief of the United States Signal Service, at San Francisco, and one of the faculty of the University of California, and Prof. Joseph Le Conte, also of the same university. From careful experiments it was ascertained that the altitude of this great mountain is 14,522 feet above sea level.

That determines that the apex of Mount Whitney is the highest point in the United States. The next highest peak is Mount Shasta, located in northern California, being 14,460 feet. The third peak is Mount Rainier, in the state of Washington—14,444 feet. Any one standing on the dizzy pinnacle of Mount Whitney can truthfully assert that he or she has stood on the "highest point in the United States." The ascent of this great peak is attended with many difficulties, much toil and no little peril. Only of recent years has it been ascended. Some days are required to make the trip to the summit and back to the haunts of civilization. The road, and latterly the narrow trail, lead over and through a most rugged, wild and precipitous region—through the very heart of the vast Sierra Nevadas.

During the past summer several parties have made the ascent of Mount Whitney. These parties have gone from San Francisco. The most notable ascent of this great mountain was that made by the famous "Sierra Club" of California. That ascent was made during the latter part of last August. The members of this club were gone about three weeks.

Mr. McAdie and Joseph LeConte Taking the Altitude of Mount Whitney, July, 1902

The crest of this peak was reached without accident, though not without great toil, hardship and danger; the descent was made with much less labor and peril. Among the party were a number of women. Notwithstanding the long and fearful climb, the women stood the trip remarkably well.

The photo shows Profs. McAdie and Le Conte with their instruments figuring out the exact altitude of Mount Whitney. Owing to the prevailing atmospheric conditions, no clearer photo could be secured. After computing the height of this vast snow sentinel, Prof. McAdie waved to the breeze a small American flag as a token of the triumph achieved. That was the loftiest point in the United States from which the Stars and Stripes have ever been unfurled.

A letter has recently been received here from George E. Hale, of Chicago, secretary of the Commission on Observatories, stating that a Carnegie observatory will be built on the summit of Mount Whitney. The building is to be 103 feet long and 30

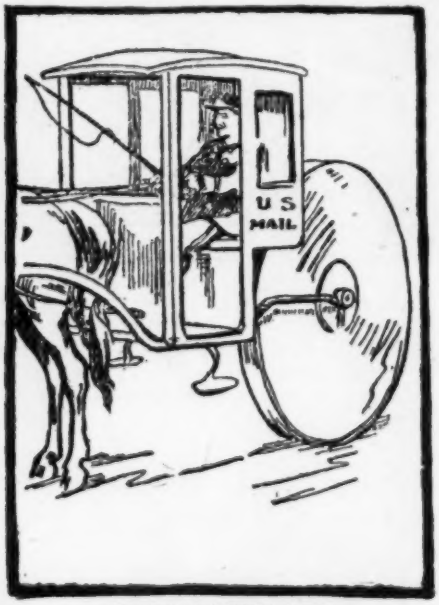
feet wide, with a porch extending around it, and be constructed of granite. All the equipments will be of the very latest type.

From the pinnacle of this peak the view is one of incomparable grandeur and surpassing beauty. It is a vision of glories never to be forgotten during a lifetime.

INVENTS A ONE-WHEELED WAGON.

Now comes an Illinoisan who tells us there is no use in having more than one wheel to light vehicles. The one-wheeled vehicle will maintain its equilibrium just as well, and is especially adapted for muddy roads, the inventor says, principally because after the trip there is just one wheel to clean instead of four.

To demonstrate the merits of his conception this Illinoisan has built a one-wheeled rural free delivery wagon. He has shown that it makes its way through mud with comparative ease and wants the United



One Wheeled Mail Wagon

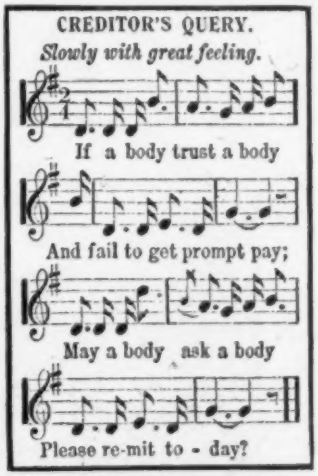
States government to adopt it for the rural free delivery service. The wheel is flat and without spokes. The vehicle is hauled by one or two horses.

British manufacturers appear to be steadily losing ground as regards agricultural machinery in Russia, says the Mechanical Review, of London, while America and Germany are continually increasing their outputs to this district.

DUNS SET TO MUSIC.

"Song of the Collector"—New Way of Coaxing Payments

"Coming Through the Rye," that delighting old song, born of the genius of Robert Burns and immortalized by prima donnas and hand organs since, has at last met its doom. Hereafter when we hear "Coming Through the Rye" we will feel like going


CREDITOR'S QUERY.
Slowly with great feeling.
If a body trust a body
And fail to get prompt pay;
May a body ask a body
Please re-mit to - day?

through the window for we will be reminded of a dun. Yes, the latest thing is a dun set to music, and "Coming Through the Rye" is the official "please remit" air that has been chosen.

A Chicago musical firm are the desecrators who have brought the ignominy on the time-honored air, but it has brought money into their pockets. The firm found there was no use in trying to force people to pay; it was not good policy to scold delinquents; gentle urging did not avail and so they devised the plan of singing to them by mail; that is, sending them a song with words and music gently entreating "remittance." The words are something of a rhythmical version of the song the collectors long had to sing in trying to get action on the debtors, but anyhow instead of their singing the same old song from the bill book it was decided to have a real song written and sent to the slothful payers, one that they had not heard the collector sing each month at the door and, while familiar, one that many of them would not so readily recognize.

Hereafter look out for bull dogs and shot guns when you serenade your girl with "Coming Through the Rye," especially if her papa bought her piano in Chicago.

Tearing Down Egypt's Temples

New Population is Playing Havoc With the Old and Hallowed Ruins

Voices of protest are sounded manywhere over the increased demolition of Egypt's ancient buildings that has resulted since the completion of the great Assuan dam. The resurrection of Egypt that has come with the curbing of the waters of the Nile to flood the desert land has caused the hurried influx of a heterogeneous population that has little regard for sacred edifices, save to tear them down for relics, and Egypt's temples and walls are now being destroyed faster than they ever were before except by an invading army.

The temple at Luxor, in ancient Thebes, whose columns have withstood the foeman's steel for 3,400 years, is now succumbing to the peaceable invasion of the age of commerce. The columns are being broken up and every ornamentation that can be detached is ruthlessly torn away. The temples at Luxor and Karnack were the largest and finest in Egypt, and are said to have covered 1,000 acres on the eastern side of the Nile. They were the pride of ancient Thebes, which once boasted of 100 gates and 20,000 chariots, and was the largest and finest city in the world.

A contributor in the Monumental News, in a recent description of the ruins of Egypt, says: "The columns of the temple at Luxor are especially fine and were better preserved than most of the others. There were several large statues of Rameses and seventeen large statues of his sons. One thing that impressed me was the way the old walls were built where it took several stones to make a course. The beds and joints were laid stone to stone and each joint was clamped with wooden clamps. They were 10 inches long by 3 inches long at ends, 2 inches in the middle and 1 inch thick. I saw a socket of wood in place that held the top pivot of a door that was apparently as sound as ever. Everywhere there was evidence of fresh demolition."

Ruins of the Temple of Luxor

HE NEEDED IT LATER.

At Cornell all the mechanical engineering students have to learn seven trades. One of these trades, that of blacksmith, is very distasteful to some of the students; but it has to be learned all the same. One young fellow, who was unusually averse to soiling his hands, begged hard to be exempted from wearing the leather apron; but the professor took special care that there was nothing lacking in the thoroughness of his training at the forge.

Last fall the student went to the professor and thanked him for being compelled to learn blacksmithing. "You see," he said, "I am now superintendent of a mine away back in Colorado. Last summer our main shaft broke and there was no one in the mine but myself who could weld it. I didn't like the job, but took off my coat and welded that shaft. It wasn't a pretty job, but she's running now.

"If I couldn't have done it, I'd have had to pack that shaft on mule-back and send it three hundred miles over the mountains to be fixed; and the mine would have had to shut down till it got back. My ability to mend that shaft raised me in the eyes of every man in the mine, and the boss raised my salary."

An Endurance Run in Truth Was This

Terrible Experiences of Men and Machines in the Remarkable 1,000 Mile New York to Pittsburg Test

Narrow escapes from drowning, thrice barely saved from being dashed down slippery mountain sides, exhaustion from hunger, sleepless nights and inhuman exposure—this is the story of the 1,000-mile automobile endurance run given by the National Association of Manufacturers. It was "endurance" almost beyond "endurance" throughout the remarkable expedition. Such another was never experienced before, and will never be experienced again by those who escaped the hazards, so they declare.

Two Cars Caught in the Susquehanna River Flood

The run was from New York to Cleveland and thence to Pittsburg, over a route specially selected by the promoters for its perils. Floods, thunder storms, washouts and numerous unlooked for catastrophes added to the distress of the men and vehicles. The automobiles at times were forced to abandon the road and take to the railroad tracks; they had to be hauled out of flooded districts by horses. Often the automobilists were up to their necks in water. The men proved to possess more endurance than the automobiles, as when the perils were at their height the automobiles stalled in the middle of streams, and the men had to wade out in the water and pilot them across. In one of the cars a can of carbide was ignited in a flood which nearly swept the vehicles from their path near Binghamton. The flames burst all over the car, creating almost a panic and seriously injuring the operator, who in consequence was forced to abandon the run.

These extracts from the Automobile's description of the run may give an idea of some of the other "endurances" encountered: "The jolting over the railroad tracks had loosened every electrical connection. Again our engine stopped, and for four hours we were looking for a spark. During this four hours the writer availed himself of the first opportunity in the last 48 hours to lie down by the side of the road under a tree and get nearly two hours' sleep. We covered 447 miles in 47 hours, with only six hours' sleep on the part of the operator, and no sleep from Saturday until Friday night on the part of either passenger or observer in our wagon, except such as we gained while sitting in the wagon.

"Horses refused to draw in our efforts to get out of the flood near Binghamton. For an hour and a quarter the operator, in water up to his waist, and sometimes above his shoulders, tugged away with the second horse. A rope 200 feet long was secured, and finally bystanders on the railroad track

succeeded in pulling the car back to its original starting place. From there it was towed back five miles to Binghamton. There new batteries and new coil were secured, and we obtained dry clothing, having traveled in wet clothes for 96 hours."

The greatest of the perils were encountered in crossing the Susquehanna river and the Allegheny mountains. Miraculous escapes from total destruction were many. There were twenty-five automobiles in the run. Sadder, more dilapidated looking equippages were rarely ever witnessed than the automobiles and riders when the vehicles, one by one, straggled into Pittsburg.

SUGAR FACTORIES ON IRRIGATED LAND.

Will the reclaimed land of western America develop into a great sugar district? This is the question now being asked by many irrigation enthusiasts and agriculturists. The success in growing the sugar beet on irrigated land of the west is such as to cause most flattering promises. The sugar beet seems to thrive on irrigated soil and to possess a commercial value from the sugar it contains that beets grown elsewhere cannot rival. Sugar factories have sprung up in many sections of the west as a result and they are doing a big business. The illustration shows a pile containing 60,000 bushels of beets awaiting shipment.

Hundreds of Carloads of Sugar Beets Dumped on the Ground Near a Western Sugar Factory

CUTTING TREES WITH COMPRESSED AIR

Many of the lumbermen in California are using compressed air in felling trees, and the method, which is the invention of a railroad man in Oregon, is said to greatly reduce the expense of hand work. Indeed it bids fair to displace axemen to a large extent.

The outfit consists of a traction engine carrying a compressed air reservoir, with long rubber tubes connected to the latter, and each of which has a pneumatic engine sawing attachment at its other end. These tubes are extended out to that part of the woods where the gang is working, and drives great cross-cut saws at a terrific rate.

One of these saws will, it is said, cut through a pine tree five feet in diameter in five minutes, whereas the same work done by two men consumed at least one hour. When the trees have been felled, two or more men are set to work cutting them into logs in the same manner.

Manufacturing Dynamite Bombs

Secluded Abodes Sought by Macedonian Insurgents Engaged in this Dangerous Work

Dynamite was one of the principal weapons employed by the insurgents against the Turks during the Macedonian insurrection. Many people were engaged in the manufacture of dynamite bombs, which during the uprising became quite an industry in Macedonia. Secluded dugouts, caves and hidden habitats of the mountains were sought by the bomb manufacturers. A photograph showing the insurgents engaged in manufacturing bombs in one of these mountainous recesses has been forwarded to Popular Mechanics by an American tourist, from which the accompanying picture is reproduced.

Making Dynamite Bombs

LIQUID FUEL FOR ROUMANIAN STEAMERS.

Le Yacht, of Paris, says: The management of the Roumanian state railways have finally decided on fitting all their steamers running in conjunction with their lines with liquid fuel burning apparatus. This decision is due to the splendid results obtained in the test of liquid fuel on one of their steamers. Calculated on a basis of the fuel consumed during 135 journeys between Constanza and Constantinople the saving effected has been estimated at 40 per cent.

A WATER WHEEL PROBLEM.

Editor Popular Mechanics:—Please let me call your attention to a little matter here that is contrary to teaching:

We have an irrigation canal here in which runs 70,000 gallons of water per minute. We have put some 16-foot under-shot water wheels therein to raise water to a higher point. We find that a wheel 16 feet in diameter and long as the ditch is wide, which is 12 feet, and 20 inches in the water, will raise 250 gallons of water per minute 25 feet high. We find that four of these wheels working in a 70-foot space in this ditch each raise 250 gallons per minute and do not raise the water in the ditch (that is, do not back it up and make it deeper above the wheels). Since one wheel does not bank up the water we were inclined to believe that a number of wheels would not do it. Since the four wheels do not bank up the water and each has the named power for raising water, we believe that should the ditch be placed full of wheels the water would go through just as rapidly. This being true, we could put three hundred 16-foot wheels in a mile of this ditch and have a little leaway to spare. These three hundred wheels would raise 75,000 gallons of water 25 feet high each minute, while it takes fourteen minutes for the 70,000 gallons of water to pass through the ditch. Figuring the 25-foot lift down to the 2-foot lift—the fall per mile in the ditch—we have 9,375,000 gallons of water raised two feet (the fall per mile in the ditch), and this each minute as against fourteen minutes for 70,000 to pass through the ditch.

I know something concerning the theory of this matter and also am aware of replies that are liable to be drawn forth; at the same time I know to a dead certainty whereof I write in this wheel matter. These wheels are here running right along unmolested week in and week out. Dozens of them are doing the same thing. I would like to have the affair straightened out some way. We are not dreaming about it, but have the demonstration here to show.

Payette, Idaho. B. W. Rice.

SHOP NOTES

THE EVOLUTION OF THE TIRE.

The greatest improvement in vehicle construction was when some bright blacksmith thought of heating the tires and shrinking them on the wheel. While many claim the honor it is not known to whom it rightly belongs. Previous to this event tires were made in short sections and held on the felloes with nails. When starting on a long haul the driver always laid in a good supply of nails to use on the trip. The West Tire Setter Co. has put into a few lines of verse this interesting historical event:

A smart smith thought of a hoop for a tire,
  Welded it up when the boss was gone,
Heated it well in a circular fire,
  Doused it with water and shrunk it on.
Many a smith would not believe it,
  Many a head was shaken "no,"
Many a one would not receive it,
  Nevertheless it was a "go."
It was a great thing, 'twas a wonderful day,
When tires were shrunk on in this new-fangled way.

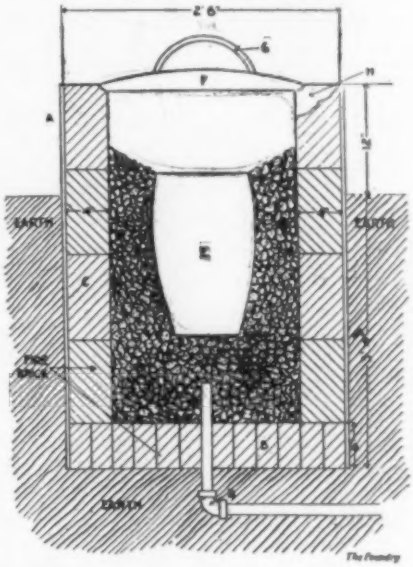
CUTTING LEFT-HAND THREAD.

To the Editor: I notice in the December number the article on cutting left-hand threads with right-hand tools. About two years ago some one advertised to tell how to do this for $5. This aroused my interest and I worked out about the same as you state except in place of the V block I placed another tap the same as on the other side. To make the nut first cut the left thread on a piece of steel, then file the gutters in it and temper it and cut the nuts.—T. N. Phillips.

HOW TO BUILD AN EMERGENCY BRASS FURNACE.

A small foundry and repair shop had occasion to use a small brass furnace for very immediate work. It is so simple in construction and has given such excellent results we illustrate it here with a condensed description from the Foundry. The cut shows a section of the furnace:

It consists of an outer shell A lined with fire brick as shown at C. The bottom of the furnace is all composed of fire brick. The cast iron cover F is provided with an iron handle G. The products of combustion escape through nicks cut on the edge of the brick work as shown at H. Dimensions are shown on illustration. The blast is taken from a small centrifugal blower which supplies the blast for the forges in the smithshop and is introduced through a one and one-quarter inch pipe shown at G.



This pipe extends about four inches above the bottom of the furnace. The fuel consists of anthracite coal of about grate-size. A bed of about 8 to 12 inches thick, depending upon the charge to be melted, is placed in the bottom of the furnace and the crucible E, set on top of it; coal is then filled in around the sides of the crucible up to the top as shown.

GIVING IRON AWAY.

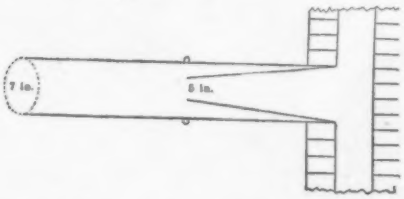
Many a manufacturing concern—and they are not all large ones—are giving away tons of iron or other metals, every year, and don't know it. The Foundry explains how this is done. It occurs in castings of considerable weight, of 250 pounds up. For instance, a large number of castings are required, to weigh, say, 250 pounds. To avoid constant repairs to a wooden pattern, an iron one is used. The pattern being heavy sinks deeper into the sand than the wooden pattern, during the rapping before its removal from the mold. This enlarges

the mold on all sides and at the bottom. When the castings are weighed it will be found that the one cast in a mold which was excessively rapped will weigh 275 pounds, or even more, instead of 250, as intended. As the manufacturer in making his price estimated on only 250 pounds, he loses the value of 25 pounds on each one.

The same result can also occur from a too rapid pouring of the metal, causing the mold to enlarge from sudden pressure, and by overfilling the riser and gates.

TO CHECK EXCESSIVE FURNACE DRAFT.

The illustration will be sufficient direction from which to construct an effective check draft for a house furnace. The furnace had an excessive draft and fairly pulled coal up the chimney, says the American Artisan.



The smoke pipe of seven inches diameter was tapered down to five where it entered the chimney. This did no good. Then a pipe section, as shown in the cut, was installed, creating an eddy, and curing the trouble.

OILING CYLINDER OF AIR COMPRESSOR.

In an address before an engineering society M. E. Stover said:

In lubricating the interior of an air compressor cylinder conditions will be found different from those existing in a steam engine cylinder. In the former the heat is dry, while in the latter moisture is always present. Moisture has a tendency to wash oil from the surfaces, whereas with a dry heat the oil adheres to the surfaces better, with the result that a given amount of oil will give better and longer service in the air cylinder than in a steam engine cylinder, both being of equal size.

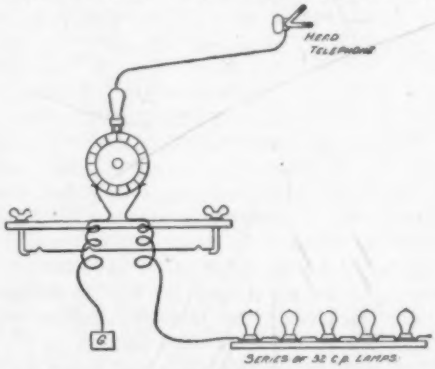
Owing to the intense heat, the oil used in an air-compressing cylinder must be of such a nature that it will not deposit a coating of carbon or burnt oil in and around the discharge valves of the compressor. If of too low flash test, the oil, on reaching the interior of compressor, will vaporize and pass off with the air without affording any lubrication to the wearing surfaces. If the oil is too dense, or is compounded with animal or vegetable oils, it will have a tendency to adhere to the discharge valves and passages, and will gradually change to a hard, brittle crust or layer of carbon, which in time will completely choke up the passages and render the valves inoperative.

RAPID METHOD OF TESTING ARMATURES.

A handy device which can be rigged in any shop, for testing armatures, is in use by the street railway at Postmouth, O., and is described in the Street Railway Review. The test is made quickly, but surely.

The armature to be tested is mounted between lathe centers and tested just after the last turning down of the commutator. A board clamped to the lathe carriage carries two brushes so placed as to make contact on the commutator 90 degrees apart; one brush is connected to the ground and the other to the trolley through a series of 32 c. p. lamps. Any telephone may be used with a head receiver to allow the operator two hands to work with. The operator should stand on an insulated platform to prevent accidental shock, in case the trolley contact should happen to be made and the ground contact broken.

The testing operation is as follows: Place the two contacts which connect with the telephone on adjacent bars; if everything is normal, and there are no open or short circuits, the operator will hear the generator current very plainly, as the telephone is in



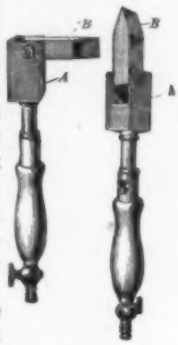
DEVICE FOR TESTING ARMATURES.

multiple with an armature coil. The armature is revolved and each pair of bars tested. Should two bars be short circuited no sound, or very little, will be heard, depending upon the resistance of the short.

If there is an open circuit no sound will be heard between any bars until the bars are found between which the open circuit occurs, when a very large sound results, as the telephone is in parallel with half the coils in series. The time required for testing by this method is only a few minutes and the cost is trifling.

NEW SOLDERING IRON.

An extremely practical gas soldering iron was recently placed upon the Berlin market. As is apparent from the illustration, the copper bit is movable and can be placed at any desired angle. By virtue of this construction the iron is of great convenience in soldering metallic edges so located as to be difficult of access. The heat generated by the gas flame (Bunsen burner) is utilized to its fullest extent in that the hollow part (A) prevents rapid radiation and concentrates the heat upon the copper bit (B). This system of heating develops a sufficiently high temperature to permit of the employment of a comparatively small piece of copper in the bit and also economizes in the amount of gas consumed. The size of the flame can be regulated at will and the apparatus attached to any gas jet by means of a hose and operated without the employment of a bellows. The short length and comparatively light weight of the iron makes it a most convenient and handy tool to manipulate.



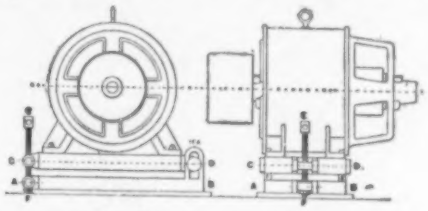
TO TIGHTEN VERTICAL MOTOR BELT.

In an English shop, where the machinery is driven by electric motors, it was necessary to use a vertical belt. The method of taking up the stretch in the belt is described in the Electrical Review, London:

A B is a fixed casting, fixed to the floor with foundation bolts, having cast on to it two slotted lugs 1 and 2.

C D is a similar casting, to which is bolted the motor. At D it is hinged to 1 and 2 by bolts which can be moved up and down the slots in 1 and 2. At C are two lugs having a nut through which the screw E F passes, being fixed at F.

When the belt is first put on C D is fixed at the top of the lugs, then the motor is levelled by screw E F, and as belt stretches C D is lowered (at one end), and when it



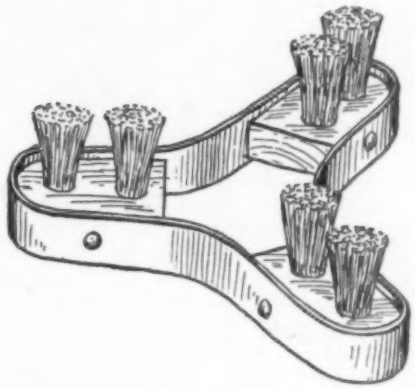
is in contact with A B and more adjustment is required, C D is lowered at the slotted lugs 1 and 2.

MILLER'S BRUSH TO CLEAN CORNERS.

A home-made device, easily prepared, for cleaning the corners of sieves in flour mills, is described in the American Miller.

This brush is made of spring steel bent into three U-shaped arms. In each arm is riveted a block of wood with bristles.

The advantage claimed is that it will never get out of shape or break. It will



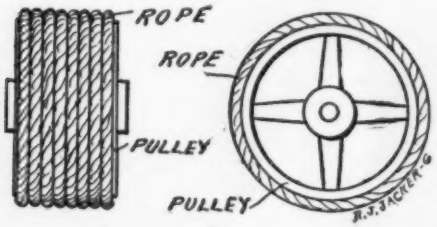
clean the corners of the sieve. It will not get clogged in the corners. It will rebound in an irregular course, thus covering all parts of the sieve. It can be made large or small, light or heavy, to suit conditions.

GASOLINE BOATS FASTER THAN STEAM.

A small boat, with say, 25-horse-power, will make better speed with a gasoline motor than a steam engine. The explanation is in the saving in weight of boiler, fuel and piping. The gasoline motor also occupies very much less space.

INCREASING PULLEY DIAMETER.

To increase the diameter of a pulley, take a four-strand manila rope and make one end fast with a hook-shaped, quarter-inch bolt. Wrap the rope tightly around the pulley, making the other end fast in the same



manner as the first one. An 8-inch pulley covered with inch rope may be used to drive a large wheat elevator. This is an inexpensive way to make a pulley larger and still leave the face true. It only takes a little time to do the work.

TREATMENT OF SOLDERING IRON.

Editor Popular Mechanics: Will you kindly give a few suggestions on the care and treatment of a soldering iron used by carriage lamp makers. What is the best method of keeping the iron bright? What is the best acid in use for soldering that class of work?

Mr. B. Rubenstein, of the Chicago Silver Plating Works, who has wide experience in this line, states: Of course it is the gas or charcoal or whatever is used in heating the iron that blackens it. To keep the iron bright first prepare a solution as follows: Put a quarter pound of sal ammoniac into a pint of water and permit it to thoroughly dissolve. Dip the iron into the solution and it will brighten immediately.

The iron needs filing every three or four hours to keep it in good condition. If it is not filed frequently it will acquire such a heavy coating of tin that it will not melt the solder.

The best acid to use for soldering this class of work is muriatic acid, cut down with zinc until it will not eat (dissolve) any more zinc. Then take three parts of the acid, cut down with the zinc, to one part of water. Be sure and clean well the parts that need soldering. Be sure and do not mix the acid and zinc in the house, for the gas that escapes when it boils up is somewhat suffocating and poisonous.

TO RECOVER CYLINDER OIL FROM CONDENSING ENGINES.

In the power house of the Camden & Suburban railway is a unique device for recovering cylinder oil. Part of the time the exhaust is discharged into the condensers. The Street Railway Journal describes a very novel and economical feature of the oiling system in an arrangement both for recovering the cylinder oil and utilizing the latent heat in the water in the hot well. The overflow from the condensers discharges into a large concrete and masonry tank, 60 ft. long by 14 ft. wide by 6 ft. deep, set the level of the boiler room floor.

This receptacle, a rough section of which is here shown, is divided by barriers into four compartments, the barriers being so arranged that the water has to flow over the first, then under the second, over the

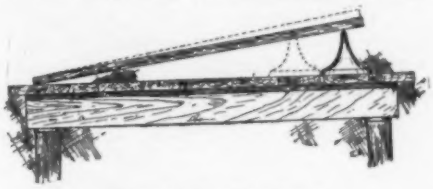
SECTION OF HOT-WELL TANK, SHOWING SKIMMERS FOR RECOVERING CYLINDER OIL

third, and so on. The overflow from condensers is led into the first of these compartments, and as it flows under and over the barriers of the tank the cylinder oil collects on the surface of the water in each compartment. In this position it is automatically skimmed off by funnel-shaped drain pipes, about 6 ins. in diameter at the top, as illustrated. It has been found possible in this way to recover about one-fifth of the oil used in cylinder lubrication. It has also been found not only practicable but desirable to use the overflow of this tank for boiler feed purposes. The temperature of the water averages about 115 degrees F., and the little oil that is mixed with the water seems to act as a boiler compound and be just enough to precipitate the mineral matter in the water; in fact, since the introduction of this water the boilers have been entirely free from scale or corrosion.

John J. Camp, of Seattle, Wash., will start in a gasoline launch 18 feet long, and attempt to follow the western coast down to Cape Horn, and then up the Atlantic shore to the St. Lawrence river. Thence through the Great Lakes to the Mississippi, up the Missouri and Snake rivers, where a short portage will bring him to the Columbia river, and thence home.

CASTING TO ELEVATE DRAFTING BOARD.

Where it is desired to use a drafting board on a flat table, the castings shown in the cut will be found of service. The Draftsman says the base of the casting should be 4½ inches in diameter, the height



Elevating Drafting Board

4 inches, terminating in a sharp point which holds the board and prevents slipping. By moving the casting various elevations of the board are secured.

BURNISHING NICKEL PLATE ON HAND LATHE.

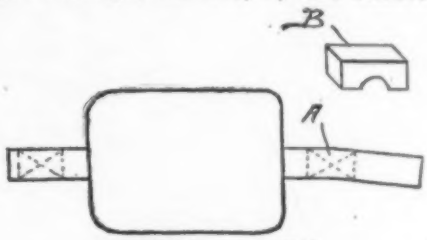
Nickel plated articles capable of being handled rapidly can be profitably burnished on a hand lathe. Some manufacturers prefer this method to buffing and the finish is more durable. In buffing a certain amount of plate is worn off, while in burnishing the surface is hardened under the burnishing tool. J. W. Force, in Metal Industry, says: I have been using the burnishing process for buttons, and some 1200 gross are treated every day. To accomplish the result, however, the solution must be properly made and maintained. The coating also must be very light; only just enough to cover the article should be put on. I use a solution which does not stand over 5 degrees hydrometer test, and even a little less is better than over.

The method which I use is as follows—viz.,: The articles to be plated are first sent to the dipping department and dipped in the usual brass dip until a good, bright, clean finish is produced. They are then rinsed in cold water, then in hot water and afterward dried in sawdust. They are now sent to the plating department. The articles are now placed in baskets, rinsed in potash solution and then in cyanide solution. The next operation is to rinse thoroughly in three waters and place in plating baskets in the plating bath. The plating is allowed to continue until a light coating is produced. They are then thoroughly rinsed in cold water, then in hot water and dried in sawdust and afterward sent to the burnishing department.. The burnishing is accomplished with the ordinary suds and burnisher.

HOW TO STAIGHTEN A SHAFT.

The following description of a quick repair of a bent shaft of an electric motor in a mill may prove useful some day. The American Miller says the shaft was bent at A, being on a bearing. The bearing could not be turned down, nor could it be mutilated from pounding. The shaft was straightened without doing either.

Mr. London had an iron, B, forged to fit about one-third of the way around the shaft. This was heated in a furnace and while hot was placed on the concave side of the bent shaft. When the shaft was slightly beyond straight the iron, B, was removed



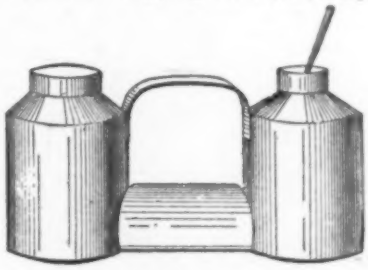
Straightening a Bent Shaft

and the shaft became straight. The heat had expanded the one side of the shaft enough to leave it perfectly straight.

DIP AND ACID CUP.

A handy device for tinners, which can easily be made is described in the American Artisan. It is especially convenient for work outside the shop.

Make two bottle-shaped cups of copper and join together with a boss and handle. In one of the cups put your flux and in the other the dipping solution (composed

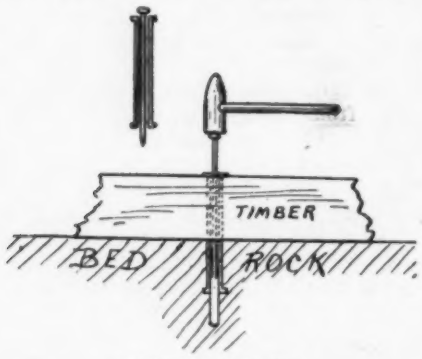


Dip and Acid Cup

of weakened flux or acid). Let the opening of the dip cup be larger than the acid cup, so you can always tell in which to put your coppers. Tin and horse hair make the swab.

TO FASTEN DAM TIMBERS TO ROCK BOTTOM.

The difficult task of securely anchoring timbers to a rock bottom for dam or other similar construction is made easy by a

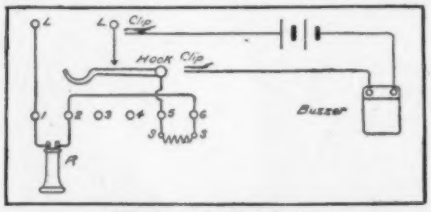


Method of Anchoring

writer in the American Miller. The illustration tells the whole story. Any blacksmith can make the fastenings, to be used as shown in the cut.

HOW TO MAKE A TELEPHONE TESTING INSTRUMENT.

It is often quite handy to a telephone inspector to have a simple testing apparatus with him while he is making his rounds, says the American Telephone Journal. The one here described is easily made, and will be found practical. It requires but a couple of small dry batteries, vest-pocket size, and a small buzzer. The dry batteries and buzzer can be carried in the pocket or a better arrangement is to mount them in a small box with a pair of flexible cords, to the ends of which snaps are soldered. Old suspender snaps will be found to answer the purpose admirably. When a station is in trouble the inspector can usually quickly decide



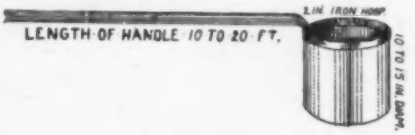
Telephone Testing Dovice

whether it is the primary or secondary circuit that is at fault. The figure represents the secondary circuit of a telephone substation instrument. Supposing an open is suspected that cannot be easily located, the inspector attaches one snap from his buzzer to the line post L' and the other he touches to the hook switch. If the buzzer sounds here, he is sure that that part of the circuit is closed, and then touches bind post number 5, still leaving the first snap at L'. If the buzzer fails to sound at 5 it is evident that the trouble is in the wire between the switch hook and the bind post 5. If, however, the buzzer sounds at 5, and does not at 6 it is evident that the open is in the secondary of the induction coil. The buzzer is better than a telephone receiver for this sort of work, as enough current to make a distinctly audible click in the receiver might flow across a partial open, while the buzzer, under the same circumstances, would not sound.

TO MAKE A CISTERN CLEANER.

Here is a description of a really good cistern cleaner, condensed from the American Artisan, with which a cistern can be cleaned without pumping out the water.

It is made of 2-in. hoop iron bent into a 10 or 15 inch circle with 6-inch straps for



Cistern Cleaner

fastening to handle. One side of the circular rim is sharp and the other is punched full of holes, say about one inch apart. Sew to this rim a sack about 15 inches deep, made preferably of gunny cloth (coffee sack) wide enough to fit the rim neatly. Sew sack to rim with malleable wire.

This is the best known cleaner, as it has a good edge for scraping up the dirt while the sack allows escape of surplus water. The sack must be sewn inside, or in such a manner so as to protect from wear near the hoop circle.

The new cruiser Maryland, which was successfully launched at Newport News recently, is 502 feet on load water line; extreme breadth 69 feet 6½ inches; trial displacement, 13,860 tons; mean draft at trial displacement, 24 feet 1 inch.

When the piano manufacturers hold their convention at Atlantic City, N. J., next summer, one of the attractions will be a great piano bonfire. A huge pile of old square pianos will be stacked on the beach, sprayed with petroleum and burned.

WHAT TO DO WITH OLD RANGE BOILERS.

A kitchen range boiler when put out of service seems to be one of the most useless things in the world. Patching and mending are a waste of money. The junk man refuses to buy them, and the plumber feels imposed upon when requested to take them away. And yet, but for some apparently insignificant weakness, the boiler which cost from $25 to $50 seems good for many years to come. A writer in the Metal Worker has discovered uses for these discarded boilers; some of them are shown in the illustration. In Pennsylvania many house holders burn their refuse and garbage; the old boiler makes an excellent incinerator by cutting off the top and inserting a grate 15 inches from the bottom. Fig. 2 is a water trough. Fig. 3 a device used by Ohio river fishermen to tar their nets, the nets being dipped in the hot tar. Figs. 4 and 5 speak for themselves. Fig. 6 shows a section of old boiler used as an expansion tank for a greenhouse heated with hot water. The height of the water in the tank is a reliable indication of its heat. The pipe holes in old boilers can be stopped with wood or iron screw plugs.

With both ends cut off they make good culverts. A rod through the center with a handle transforms an old boiler into a good lawn roller. With one end cut off and buried in the ground it makes a fairly good refrigerator as a temperature of 52 degrees can be thus secured. Other uses will suggest themselves to our readers.

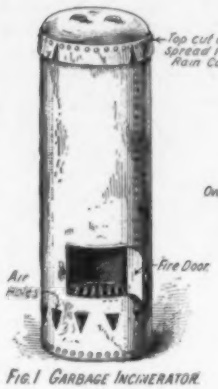


FIG. 1 GARBAGE INCINERATOR.

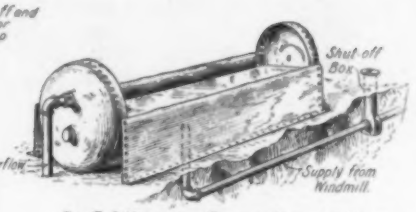


FIG 2. A KENTUCKY TAVERN DRINKING TROUGH.

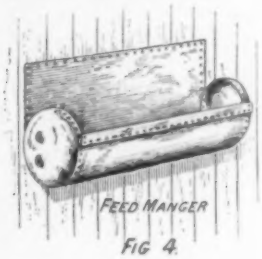


FIG 4.

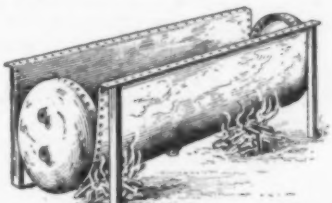


FIG 3. AN OHIO RIVER FISHERMANS SCHEME FOR TARRING NETS.

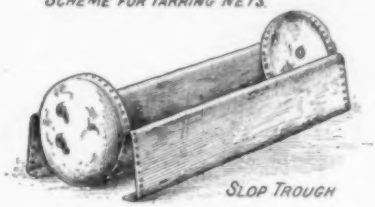


FIG. 5

EXPANSION TANK.
FIG. 6.

The Prince of Wales has a most extraordinary design tattooed on his arm. It takes the form of a fearful looking dragon, with open jaws bristling with rows of gigantic teeth, and a row of spiked horns down the middle of its back.

FREIGHT CARS ORDERED IN 1903.

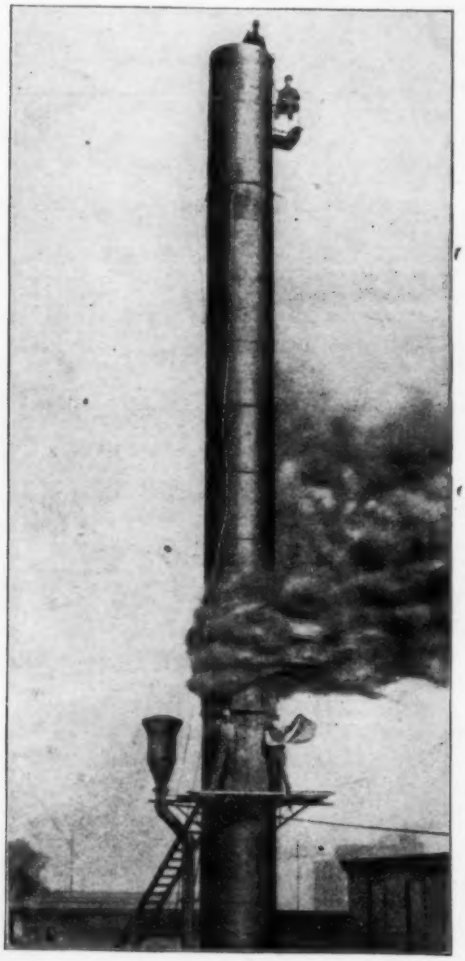
There is always great interest in railroad circles to know the number of freight cars ordered during the year, as affording an indication of traffic present and prospective. The Railway Age has compiled the figures, which are: Freight cars, 108,936; passenger equipment, 2,319; locomotives, 3,283.

In 1902 the orders were: Freight cars, 195,248; passenger equipment, 3,459; and locomotives, 4,665.

A Toledo, O., man has invented a self-starting gasoline engine for automobiles. The engine is a vertical two-cylinder, and after being once started in the morning will start any time during the day by pushing a button. One cylinder always is charged with compressed gas, which of course would lose its efficiency in about 20 hours.

LENGTHENING A SMOKESTACK WHILE IN USE.

The 110-foot round iron smokestack of the Century Building in Indianapolis was recently lengthened 60 feet while the boilers and plant were in full operation. The



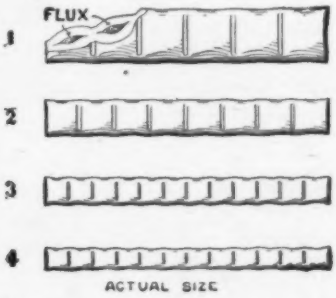
Lengthing a Stack While in Use

stack had long been a source of annoyance to occupants of nearby tall buildings, and to extend it without banking the fires and shutting off the power of the manufacturing companies occupying the Century Building was considered impossible by local engineers. W. H. Schott, consulting engineer of Chicago, was called upon and in an ingenious and effective way accomplished the job. A damper was placed in the old stack a few feet below the top and two holes were cut into the sides a short distance below the damper. This permitted the escape of the smoke and gases, and the workmen were able to rivet the previously prepared sheets into place with but little difficulty. The stack is five feet in diameter and was extended to a height of 170 feet in eight days. The accompanying illustration is reproduced from the Iron Age.

SOLDERING.

The best solder for ordinary purposes is called "half and half," i. e. 50 per cent tin and 50 per cent lead. More lead and less tin makes softer and poorer solder and raises the melting point. An addition of proper proportion of bismuth reduces the melting point but greatly increases the cost.

To join surfaces by solder, they must be thoroughly clean and heated sufficiently to melt the solder. Heating causes both the solder and the surfaces to rapidly oxidize and oxides are fatal to good joints. To pre-



vent oxidization as much as possible and to carry the oxides away, acid or fluxes are used. An excellent flux is one that has both an active reagent to cut away any foreign matter from surfaces and a protective ingredient which will shield the hot surfaces from the air until the solder can run in and take its place, which it does by capillary attraction.

Different metals require different fluxes.

Muriatic (HCl) acid and zinc, decanted, makes a fairly good (but corrosive) fluid for tin plate, brass, copper or steel. Tallow or stearine for lead. Resin for lead or tin plate. These are the most common.

To "tin" a copper, do not have it too hot. File bright, quickly rub with sal ammoniac or dip in paste or salts solution and apply solder before the copper has time to oxidize.

Few manufacturers realize how much can be saved by having things convenient. At least, there are few methods employed that can not be improved upon. Most operatives have but two hands. In any case where

operations must be repeated rapidly and many times, it is important to have only two things to manipulate, one for each hand. In many, possibly most cases where the work is light, all the time spent in moving the soldering copper is lost.

However, there still remain three motions, viz., bringing the work, the flux and the solder up to the copper. These three motions can be reduced to two, when a self-fluxing solder is used.

Where the surfaces to be united are very extensive a method called "sweating" is employed. This is done in several ways. The writer has employed two methods in his experience covering many thousands of square feet of work. The first method was to coat both surfaces with solder (over a hot stove) by means of wire brush and crystal of sal ammoniac and, as soon as solder was set, to coat with rosin to prevent oxidization. The two plates thus covered were clamped face to face and "baked" in an oven.

A more economical method was to lay a sheet of solder foil, 5-1000 inch thick, coated with flux, between the plates. These were clamped together and baked as above. The latter method proved more economical and reliable. The plates above mentioned were of brass or bronze twelve by forty-two inches; one plate being ⅜ inch thick and the other but 1-16 inch. Every square centimeter of the entire surface had to be soldered. By the use of self-fluxing solder it is possible to do much soldering without a copper. Merely heat the article and apply the solder.

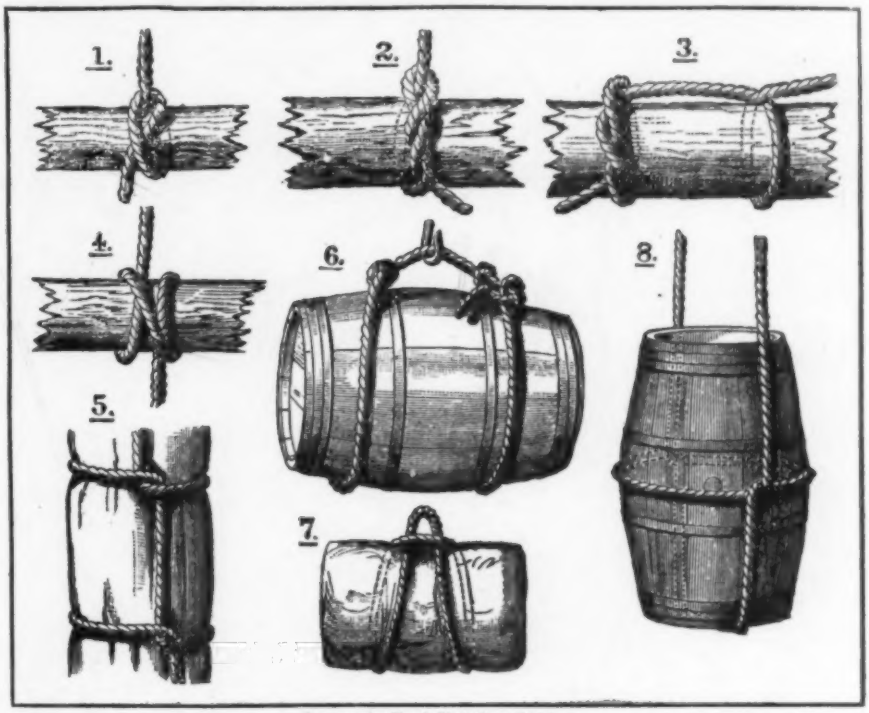
F. G. Dickerson.

HOW TO TIE A HITCHING KNOT.

A knowledge of how to tie the hitching knots, which are a part of the education of every sailor, will be valuable to all our readers. The illustration is from the Scientific American. A piece of white cotton clothes line is most suitable for practice.

No. 1 is the so-called half hitch, which is so common as to be familiar to nearly everyone. No. 2 is known as the timber hitch, and is particularly useful when medium-sized sticks of timber are to be hauled about. No. 3 is a combination of the timber hitch and half hitch, that is particularly advantageous when longer sticks are to be handled. No. 4 is the famous clove hitch that is more frequently used than any other form of rope fastening.

Nos. 5, 6, 7 and 8 are self-explanatory methods of making slings whereby articles of almost any shape or description may be readily attached to a fall for hoisting.



Commonly Used Hoisting Hitches.

Teach Soldiers to Shoot Straight

This, the Problem of Most Vital Importance, Says Col. W. P. Hall

American Army's Fighting Strength Today and 100 Years Ago

Size of regular army	60,000	ized in ninety days	500,000
Could be mobilized at any point in the United States in five days	45,000	Total available men capable of bearing arms	10,853,396
Could be increased in ten days to	100,000	Size of the army 100 years ago: Two regiments of artillery and engineers, two companies of light dragoons, four regiments of infantry—318 officers, 4,118 men,	
Military reserve strength in United States	118,000		
Could be recruited, equipped and mobil-			

By Col. W. P. Hall. Acting Adjutant General, U. S. A.

The future of the military establishment of our country seems to be very bright. The harbors which it is considered best to fortify against naval forces are rapidly being put in condition to make easy their successful defense. Our land forces, our regular army and militia are being trained on lines to make them quickly available for any emergency and to give them efficiency on the field of battle. The problem of the concentration of troops at certain points is, on account of the many railroad lines and other wonderful carrying capacity, quite a simple one, while the field maneuvers, practice marches and camps of instruction give the valuable lessons required for their disposition and handling in action and teaching the soldier how to shoot his arms and hit what he shoots at.

With the long range, high power miltary weapon now in use it becomes of more vital importance than ever before that the shooter should be a good marksman. If the all-round military efficiency be designated by ten points, at least eight of them are excellence in marksmanship.

In shooting a rifle at long range, if the shooter misses the object he intends to hit, the shot is generally lost and he is something like the quail shooter who fires at the flock when the covey gets up.

The value and importance of high efficiency in military rifle shooting on the field of battle was never so forcibly illustrated as during the Santiago campaign. For eighteen years previous to this our little army had received an excellent and thorough training in target practice and was as a class fine miltary rifle shots. They had been trained, with other things, to shoot at an object the size of a man's head and shoulders between five and six hundred yards, and many of them would hit, firing rapidly nine times out of ten.

At Santiago our troops marched over an open space from four to six hundred yards to attack an enemy in well constructed rifle pits upon the other side; our loss was comparatively small, and it is acknowledged that our opponents were very poor shots, and it is said they had received little or no training in rifle shooting.

In conversaton wih a number of our fine rifle shots who were in this campaign, I have gathered these facts, and one very sensible man remarked that if our men had been in the trenches they could easily have destroyed ten times their number of an attacking force. These remarks are not intended to and cannot cast a reflection upon any soldier opposed to us.

It is like a fine tennis or golf player engaging in a game with one who cannot play a little bit; the result is inevitable.

In concluson, I will add that rifle shooting can be easily taught by proper training in the gallery and does not require a large expenditure of ammunition or much practice upon the range.

The responsibility of teaching soldiers how to shoot rests with the captains and lieutenants, and in order to teach it correctly they must know how to do it themselves.

I am glad to say that Congress is disposed to be liberal in appropriating for shooting galleries and ranges, and it is hoped our regular troops and militia and the various rifle and revolver clubs will soon be engaged in friendly shooting competitions all over the country.

In this way we will soon have an army ready to take the field on short notice, and their efficiency for effective work on the line of battle will be second to none.

A publisher has discovered that a bushel of wheat contains 869,720 grains.

"SHORT TIME TO MAKE A MEETING POINT."—Haste is imperative, for the snow is falling in perilous quantity, and the tracks may be blocked before the end of the division is reached. Such thoughts filled the mind of many a trainman and the scene the illustration depicts was of frequent recurrence in the western states of America during the month of January. The picture from Railroad Trainmen's Journal. It is so typical of many such scenes that dozens of trainmen will at once recognize it as the identical storm they experienced at such and such a place. The month of January in the west was especially perilous for railway traffic on account of the unprecedented heavy fall of snow. Old trainmen say they never knew snow to come down in such blinding magnitude as it did in many sections. Wrecks were numerous; great property loss was experienced and many lives were lost. During some of the storms in mid-day it would turn as dark as night because of the lowering skies and the impenetrable thickness of the area of descending snowflakes.

EASY ELECTRICAL EXPERIMENTS

A SIMPLE ELECTRIC LAMP OUTFIT.

The electric lamp shown in the cut below is a very serviceable device. Used in connection with a clock which may be placed behind the lamp, it is possible to tell the time in the darkest night, and that without moving from one's bed, if it is so desired. Small electric lamps suitable for such an outfit may be purchased quite cheaply. For the outfit to be described, a ½ candle power lamp requiring 4 volts should be purchased, together with a small porcelain base for holding the lamp. Any large dealer in electrical supplies should be able to furnish these.

The amateur will only need to construct a suitable battery for running the lamp, and a wooden base for holding the battery and

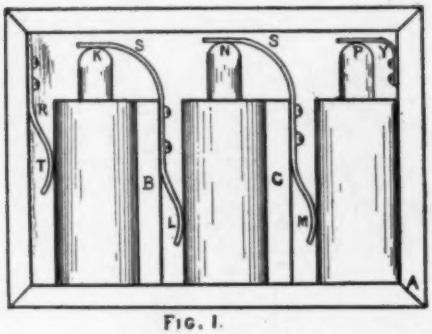


FIG. 1.

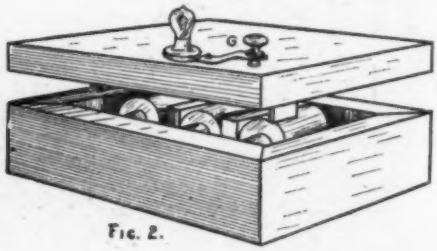


FIG. 2.

for supporting the lamp and the clock. Dry cells are used, of which three will be required. They may be constructed as follows: From a piece of sheet zinc cut out a piece 4 inches long by 3 inches wide. Roll this into a smooth cylinder three inches long by 1⅛ inches in external diameter, and solder the overlapping edges. Then cut out a circular piece of zinc 1 3-16 inches in diameter, and solder it on to one end of the cylinder, so as to form a tight zinc cup, 3 inches in height and water tight.

Now take a piece of electric lamp carbon such as may be picked up in the street after the lamp trimmer has made his rounds. This piece should be 3¼ inches in length. Select one which seems to have a thick plating of copper, and file off this copper except at one end. The copper is left on here, so as to enable a good contact to be made with the carbon. From the sole of an old rubber shoe cut out some rubber rings which will just fit tightly over the carbons and slip smoothly inside the zinc cylinder. These ruber rings are to keep the carbon from touching the zinc at any point. Immerse the copper plated ends of the carbons in a dish of boiling hot paraffine wax for one hour, the paraffine extending for ¾ inch from the end. This process is very necessary, and care should be taken to see that the pores of the carbon at this end are completely filled with the boiling wax. Three carbons, three zinc cups and six washers will be required in all. We must next make a mixture or paste with which to fill the cells. This paste is made up by mixing ¼ pound zinc oxide, 6 oz. of sal-ammoniac, ¼ lb. plaster of paris, ¼ pound chloride of zinc and ½ pint of water. As soon as the paste is mixed, it should be put into the zinc cups. First put in a thin layer in the bottom of each cup. Then place one of the rubber washers on the uncoated end of one of the carbons, and insert it and the washer into the cup, leaving ⅝ inch of the carbon projecting from the top of the cup. Then commence to put in the paste, pushing it in with a stick, until it is within ½ inch of the top. Then push a second rubber washer around the carbon rod and into the zinc cup, until it rests on the top of the paste. Now set the cell to one side, and proceed to fill the remaining two in a like manner. When the three cells are filled, melt together in a ladle ½ pound of rosin and 2 oz. of beeswax. This forms a kind of sealing wax which should be poured over the top of the paste, effectually sealing the cells. If it is possible to secure some pitch, it may be used instead of this wax, with better results. The cells are now complete and ready for service.

A neat wooden base should next be made for holding the cells. A plan of this base is

shown in Fig. 1. A piece of whitewood 5 by 6 by ½ inch should be carefully finished up. Then cut out two strips of the same material 5 by 1⅛ by 12 inches, and two strips 6¼ by 1⅛ by ½ inches. These are for forming the sides of a shallow box of which the large piece just mentioned is the base. Cut the ends of the strips in a mitre box as shown at A, Fig. 1, and fasten them to the base with glue and brads, making a box whose inside dimensions are 4 by 5¼ by 1⅛ inches. Now cut out two more strips 3 by 1⅛ by ½ inches and finish them so that they may be inserted in the inside of our box as shown at B and C. Before glueing them in place, however, two springs shown at S should be made. These are made from heavy spring brass, and are ½ inch wide and 4½ inches long. At one end they are bent around in a smooth bend so as to make them of the shape shown at S. Then the long end of the spring is fastened to the side of the strips B and C, in such a manner that when these strips are in place the springs will just clear the side of the box at K and N. The springs are fastened to B and C by two screws, which enter B and C near the end nearest the bend. Then the straight ends of the springs are bent slightly outward, as shown at L and M.

These springs are for making connections between the cells. The wooden strips B and C are inserted, so as to divide the box into three equal compartments. Then when a cell is slipped into each of these compartments, the carbon of cell number one should make contact with the first spring at K. The other end of this spring should press firmly against the zinc of cell number two. Likewise the carbon of cell number two is connected at N to the second spring, which in turn connects with the zinc of number three at M. To complete the connections, a spring shown at Y should be provided, and also one shown at R, the former making contact with the carbon of the third cell, the latter with the zinc of the first cell.

A cover to fit the box should be made, with two brass lugs projecting from the under side so as to press against Y and R, the brass lugs connecting by wires to the terminals of the little lamp, which is mounted on the top of the cover as shown in Fig. 2. One of these connecting wires should, however, pass through a contact key shown at G, Fig. 2, so that the lamp will be lighted only when the key is pressed.

The life of the batteries will depend upon how much they are used. The lamp should not be burned continuously but only for the shortest possible time. Instead of the key on the cover of the box, a key located at any convenient place in the room may be used.

CHARCOAL BURNING IN NEW ENGLAND.

Burning charcoal is quite an extensive industry in many parts of New England. In certain districts there may be found old men engaged in the work, whose fathers and grandfathers before them conducted the same occupation in the same place. The same primitive method of "setting up" a pit that was employed a hundred years ago, is described in the Rural New Yorker. Sticks of pine, oak, alder, birch or hemlock,

Charcoal Pit

are cut into pieces about seven feet long, and set up on end to form a cone from eight to ten feet high, pointed at the top, where a hole is left to let out the smoke. The pile is then covered with ferns and leaves, and over these is shoveled earth to a height of about six feet. The remainder of the pile is covered with heavy sod. Two rows of small holes to let in air are made, the aperatures about one foot apart and extending all the way around the kiln.

When all is ready some blazing bark is dropped through the hole at the top. The pit must be watched night and day. If blue smoke appears it means the fire is burning too rapidly and some of the holes are closed. In ten or twelve days the burn is complete and the cover is removed and the charcoal taken out, cooled, and is ready for market. Alder makes the best and hemlock the poorest grade of charcoal.

When you want anything and don't know where to get it, write Popular Mechanics.

MECHANICS FOR YOUNG AMERICA

Coasting Sleds, Chair Sleighs, Toboggan Slides, Skis and How to Make Them

Make your own sleds, boys! There is no use in buying them, because your hand-made sled is probably better than any purchased one and then you can take so much more pride in it when you know it is of your own construction. There are so many different designs of sleds that can be made by hand that the matter can be left almost entirely

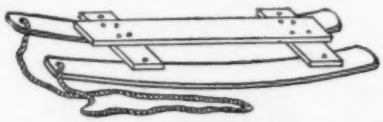


Fig. 1.—Barrel Stave Sled

to your own ingenuity. You can make one like the bought sleds and face the runners with pieces of an iron hoop which will answer every purpose. A good sled for coasting consists simply of two barrel staves and three pieces of board as shown in the picture, Fig. 1. No bought sled will equal it for coasting and it is also just the thing for carrying loads of snow for building snow houses. The method of its construction is so simple that no other description is needed than the picture. You can make a chair-sleigh out of this by fitting a chair on the cross board instead of the long top board or it will be still stronger if the top board is allowed to remain, and then you will have a device that can readily again be transformed into a coasting sled. In making the chair-sleigh it is necessary, in order to hold the chair in place, to nail four L-shaped blocks on the cross boards, one for each leg

Chair Sleigh

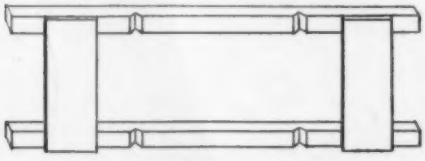


Fig. 2.—Folding Chair Sleigh Bottom

of the chair. Skating along over the ice and pushing the chair in front of him the proud possessor of a chair-sleigh may take his mother, grown sister or lady friend with him on his outings, and permit her to ride in the chair.

FOLDING CHAIR SLEIGH.

A folding chair sleigh is even more enjoyable and convenient than the device just described. If the ice pond is far from home this may be placed under your arm and carried where you like.

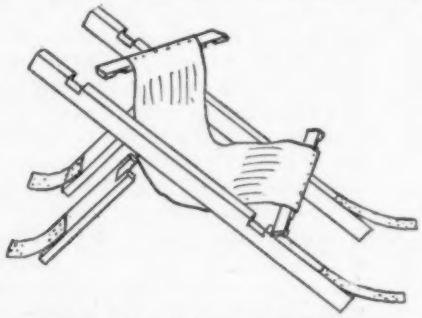


Fig. 3.—Folding Chair Sleigh.—Top Parts Disconnected

The illustrations, Figs. 2 and 3, show all the parts as they should look before being joined together. The seat may be made of

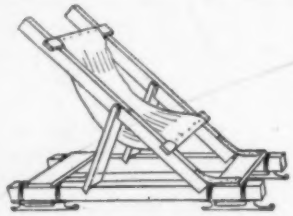


Fig. 4.—Folding Chair Sleigh Open

a piece of canvas or carpet. The hinges are of leather. Fig. 4 shows the folding chair sleigh after it has been put together. Skates are employed for the runners. The skates may be strapped on or taken off whenever

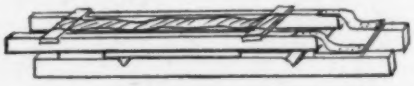


Fig. 5.—Folding Chair Sleigh Closed

desired. When the chair is lifted the supports slip from the notches on the side bars

and fall on the runner bars. The chair is then folded up so that it can be carried by a small boy. With regular metal hinges and light timbers a very handsome chair can be constructed that will also afford an ornamental lawn chair for summer.

THE TOBAGGAN SLED.

When the snow is very deep a toboggan sled is the thing for real sport. The runners of the ordinary sled break through the crust of the deep snow, blocking the progress, and spoiling the fun. The toboggan sled, with its broad, smooth bottom, glides along over the soft surface with perfect ease.

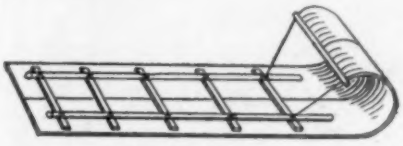


Fig. 6.—The Toboggan

To make the toboggan sled, secure two boards each ten feet long and one foot wide and so thin that they can be easily bent. Place the boards beside each other and join them together with cross sticks. Screw the boards to the cross stick from the bottom and be sure that the heads of the screws are buried deep enough in the wood to not protrude, so that the bottom will present an absolutely smooth surface to the snow. Fasten two side bars to the top of the cross sticks and screw them firmly. In some instances the timbers are fastened together by strings, a groove being cut in the bottom of the boards so as to keep the strings from protruding and being ground to pieces. After the side bars are securely fastened, bend the ends of the boards over and tie them to the ends of the front cross bar to hold them in position. See Fig. 6. The strings for keeping the boards bent must be very strong. Pieces of stout wire, or a slender steel rod, are even better. The toboggan slide is the favored device of sport among the boys in Canada, where nearly every boy knows how to make them.

THE NORWEGIAN SKI.

You have often read of the ski, the snowshoe used by the Norwegians and other people living in the far north. With them the men and women glide down the snow-covered mountain sides, leap across ditches, run races and have all kinds of sport. They are just as amusing to the American boy who has ever learned to manipulate them, and it is wonderful how much skill can be attained in their use. Any boy with a little mechanical ingenuity can make a pair of skis (pronounced skees). They can be made from two barrel staves. Select staves of straight grained wood. Sharpen the ends of each and score each end by cutting grooves in the wood, as shown in the cut, Fig. 7. A pocket knife or small gouge will suffice for this work. Then smear the end of the staves with oil and hold them close to a hot fire until they can be bent so as to tip the toes upward, as shown in the picture, Fig. 7. Then with a cord bind the staves as they are bent and permit them to remain thus tied until they retain the curved form of their own accord. Now screw on top of each ski a little block, just broad and high enough to fit in front of the heels of your shoe. Fasten a strap in front of each block through which to slip your toes, and the skis are made. The inside of the shoe heel should press firmly against the block and the toe be held tightly under the strap. This will keep the skis on your feet. Now procure a stick with which to steer and hunt a snow bank. At first you will afford more amusement to onlookers than to yourself, for the skis have a way of trying to run in opposite directions, crosswise and various ways, but with practice you will soon become expert in their manipulation.

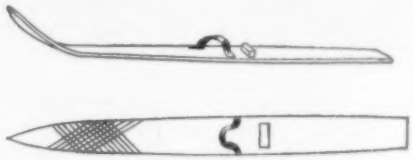


Fig. 7.—Skis

The building of a Canadian armed cruiser for the Great Lakes has caused comment on the treaty supposed to restrict such a movement.

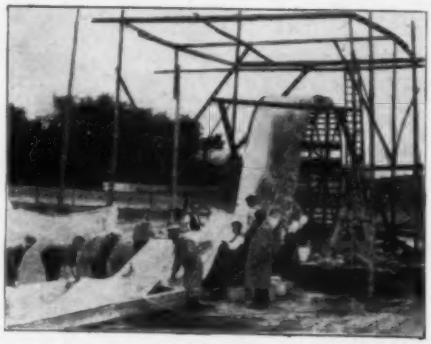
John D. Rockefeller's gift of twelve millions to the University of Chicago should be appreciated. It takes John nearly twlve weeks' hard work to earn that much money.

The Swiss government is considering the advisability of substituting electricity for steam as a motive power on all the railroads of that country.

Largest Photograph in the World

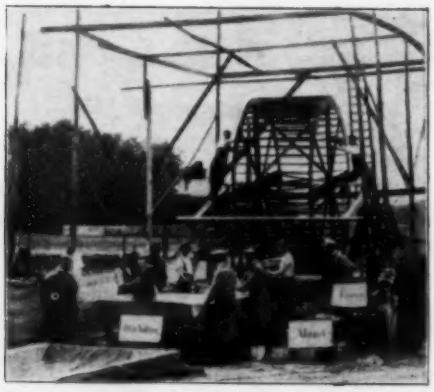
Special Machinery Built for Producing a Picture 12 Yards Long and 1 1-2 Yards High

A photograph 12 yards long and 1½ yards high has recently been produced in Naples. It is the largest photograph in the world and the marvel of the art in all lands. The feat was performed by the New Photographic Company of Berlin. It is a photograph of the Bay of Naples and was taken from Castello Marino, the highest point of the mountains surrounding Naples. It shows the bay from Vesuvius to Capri. Six plates were used in making the photograph. The image was enlarged direct on to bromide paper, each section measuring 1½ yards by 2 yards. The development had to be done in the open air by night. Only two copies of the remarkable picture were made. One is to be exhibited in Dresden and the other at the St. Louis exposition.



Method of Washing Print in Specially Constructed Vat

Retouching by Night



Preparations for Fixing the Great Winding Wheel

In producing this photograph it was necessary to make special machinery, unlike any ever used by a photographer before. It was necessary to climb up on ladders to perform the work of developing. A great winding wheel was constructed on which to roll the photograph while it was being developed. Four stages in the process of preparing the picture are shown in the illustrations.

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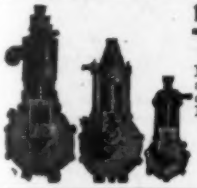

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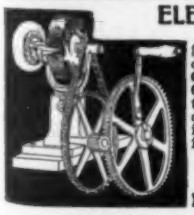

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DUST DEFLECTORS FOR AUTOS.

A deflector which can be attached to any automobile, and which prevents the dust thrown up by the

wheels from pouring over the occupants, is a recent invention. The cut shows the manner in which it is used.

DELAYS ARE COSTLY.

In no other line of work is the danger of delay greater than in that of securing a patent on a new idea, that is, if the inventor has any intention of protecting his rights. Procrastination in applying for a patent promptly has robbed many a man of a fortune which was almost within his grasp.

It is said of one of the greatest electrical patents ever issued, that the real inventor thinking the danger remote of anyone else conceiving the same idea, instead of applying for his patent made application instead for a caveat, intending to make further improvements and have the paper issued on the final perfected device.

While he was still engaged in leisurely working out an improvement, another with more push, submitted a complete model and was granted the patent, which subsequent litigation involving hundreds of thousands of dollars did not invalidate. The result was that the originator of one of the most valuable patents ever granted in any country, never realized on his ideas, and spent his money and that of his friends in trying to recover the lost ground. One man made millions; the other remains comparatively poor.

The commissioner of patents, and the courts give preference to the diligent inventor; the one who asks for his patent while the other is thinking about doing so. The latter may really be, and frequently is, the original inventor, but the patent office can recognize only the one who comes to it first; it cannot go about the country advertising for the original inventor; it can only take notice of the one who first presents his claims, and such an one is considered legally the worthy party.

If you have an invention which you think is worth patenting at all, better "do it now."

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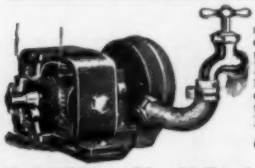

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DREW THE WRONG LEVER.

This is what the switchman said,
With both hands at his throbbing head:
"I pulled the wrong lever standing here,
And the safety signal stood out clear;
But before I could draw it back again,
In came the fast express and then—
Then came a roar and a crash that shook
This cabin floor, but I would not look
At the wreck, for I knew the dead would peer
With strange dull eyes at their murderer here."
"Drew the wrong lever!" "Yes, I say!
Go, tell my wife, and—take me away!"

That was what the switchman said,
With both hands at his throbbing head.
O' ye of the twentieth century time,
Who hold low dividends as a crime,
Listen! So long as twelve hours' strain
Rests like a load of lead on the brain,
With its ringing of bells and its rolling of wheels,
Drawing of levers until one feels
The hands grow numb with a nerveless touch,
And the handles shake and slip in the clutch,
So long will you have the switchman say,
"Drew the wrong lever; take me away!

GERMANY GETS PEKING LIGHTING CONTRACT.

The Chinese government has placed an order with a Hamburg firm for a new electric lighting plant in Peking for lighting the Chinese imperial palaces in and near the capitol. The new plant is to take the place of one destroyed during the Boxer disturbances. The installation is to be worked on the alternating curret system and comprises four steam engines and boilers and 16 transformers. The plant will supply light to the winter palace with its extensive grounds in the center of the city and to the summer residence outside the city.

QUICK STOPPING OF ELECTRIC CARS.

In recent European experiments it was found that an electric car could make an emergency stop from a speed of 20 miles an hour in 88 feet, which was just 2½ times the length of the car. The stop was effected by reversing the motors, an appliance being used which prevented the controller from being moved over too rapidly and thus skidding the wheels. With the same device used in starting, the car attained a speed of 20 miles an hour in 16 seconds and of 18¼ miles an hour in 12 seconds.

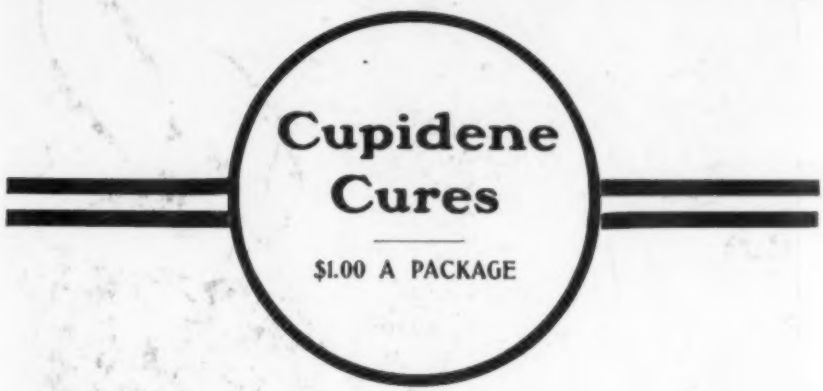
CUNARD INVESTIGATES THE TURBINE.

To determine upon the advisability of equipping all their new steamers with turbines, the Cunard Steamship Company has appointed a commission to make a thorough investigation of turbine propulsion. Economy in space, fuel consumption and speed are the main questions to be inquired into. A favorable report by the commission will doubtless mean the universal adoption of the turbine for ocean traffic.

HINTS TO INVENTORS.

A movable cellar step which, when trod upon, will turn off a switch and thus extinguish all electric lights, is suggested as a needed invention. It is claimed that the device would meet a ready market because of the general carelessness of warehousemen.

Tobacco Weak Heart



There comes a time when the cigarette must go—when the weakness must be overcome. Every man owes it to himself, to his futurity to be strong, vigorous, lusty. Now you have broken the laws of nature, broken the rules of health, laid violent hands on the powerful organs of the body, yes, you must expect to be weak. You smoke tobacco beyond the dictates of prudence, burn your candle at both ends, and even in the middle, then you become a poor, miserable man. You have sown the seeds of violence, you must reap the harvest of weakness.

THERE IS A CHANCE for you; just one chance. You can overcome your follies, you can stop the losses of night and day, you can be made well—by the use of **CUPIDENE**. There is only one and one only **CUPIDENE**. It is the **WEAK MAN'S** remedy. **CUPIDENE** cures prematureness, varicocele, hydrocele, knotted veins. **CUPIDENE** cures the mind that is frail, the body that is weak; cures the bleary eye, the all-gone man. **CUPIDENE** lifts you out of the rut. Puts vim and life into your entire system.

NOTE THE SYMPTOMS

CUPIDENE cures dizziness, mental incapacity, fits of weakness, despondency, rush of blood to the head, giddiness, loss of sleep, purility, hypochondria, lack of power, knocking knees, irritability, night sweats, hot and cold flashes, kidney and bladder disorders, swelling under eyes, puffiness of eyes, poor circulation of the blood, numbness, enlargment of the seminal ducts. **CUPIDENE** cures just as certain as you are a weak man. Give **CUPIDENE** a fair, impartial trial. Don't trifle with yourself any more. **CUPIDENE** is sold under a guarantee. **CUPIDENE** is O.K. Try this man's remedy. 20 years' of use, 20 years' of testimonials.

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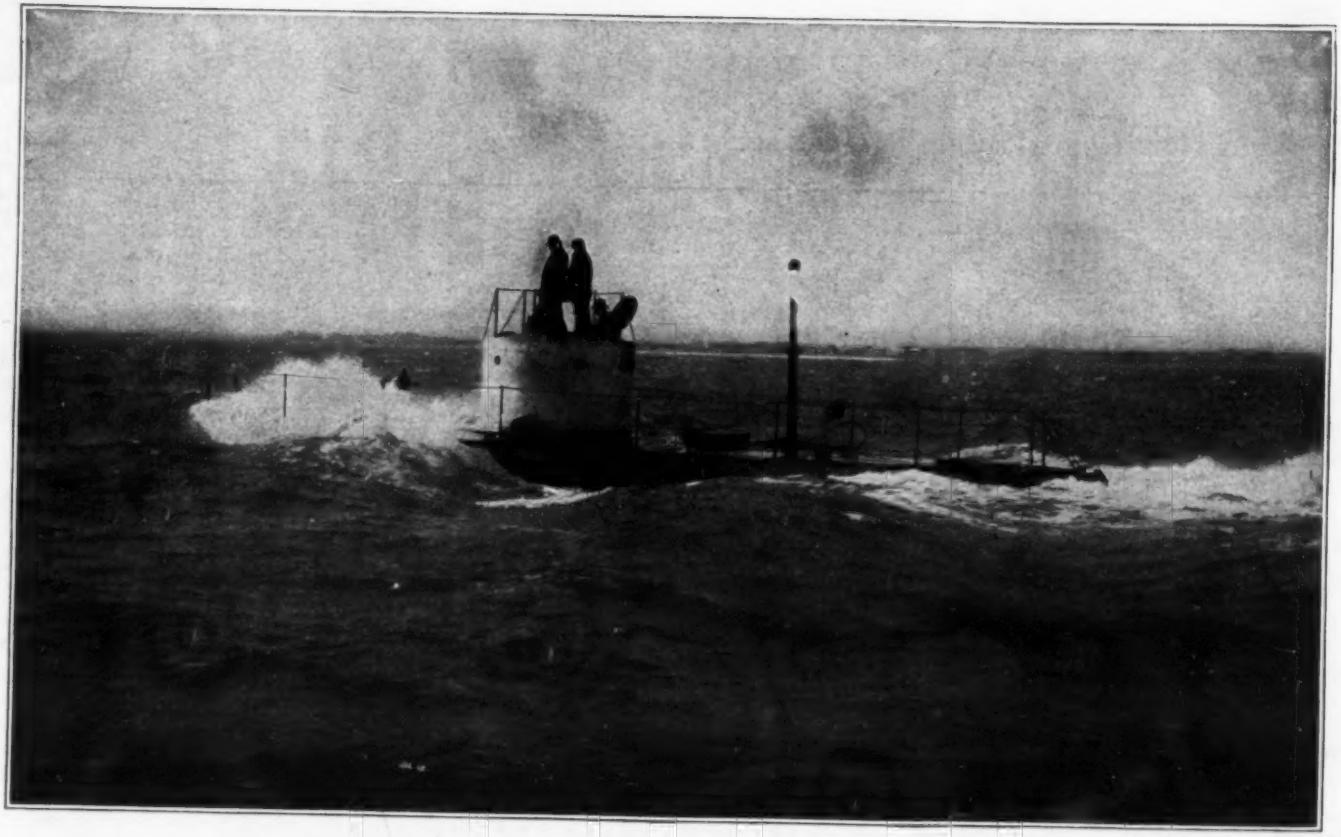

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